Colorado River Basin Salinity Control Program
Federal Accomplishments Report for Fiscal Year 2014

Presented to

Colorado River Basin Salinity Control
Advisory Council

by

United States Department of Agriculture
Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
Bureau of Land Management
Bureau of Reclamation

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Colorado River Basin Salinity Control Program
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Acronyms and Abbreviations

Advisory Council	Colorado River Basin Salinity Control Advisory Council
ASCS	Agricultural Stabilization and Conservation Service
Basinwide Program	Basinwide Salinity Control Program
BLM	Bureau of Land Management
BSP	Basin States Program
CAP	Central Arizona Project
CRBSCP	Colorado River Basin Salinity Control Program
CRSS	Colorado River Simulation System
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FAIRA	Federal Agricultural Improvement and Reform Act
FOA	Funding Opportunity Announcement
Forum	Colorado River Basin Salinity Control Forum
FSRIA	Farm Security and Rural Investment Act
FY	Fiscal Year
GGNCA	Gunnison Gorge National Conservation Area
GIS	Geographic Information System
HDB	Hydrologic Date Base
NCA	National Conservation Area
NIWQP	National Irrigation Water Quality Program
NRCS	Natural Resources Conservation Service
Reclamation	Bureau of Reclamation
RMP	Resource Management Plan
Service	U.S. Fish and Wildlife Service
TDS	Total Dissolved Solids
TMS	Technical Modeling Subcommittee
USDA	United States Department of Agriculture
USGS	U.S. Geological Survey
UVWUA	Uncompahgre Valley Water Users Association
Work Group	Colorado River Basin Salinity Control Forum's Work Group

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The NRCS of the USDA conducts Colorado River Basin Salinity Control activities primarily under the authorities of the Environmental Quality Incentives Program (EQIP). EQIP was enacted with passage of PL104-127, Federal Agricultural Improvement Act of 1996, a.k.a. "1996 Farm Bill."

EQIP has been reauthorized three times; (1) PL 107-171, The Farm Security and Rural Investment Act of 2002, (2) PL 110-246, The Food, Conservation, and Energy Act of 2008, and most recently (3) PL 113-79, The Agricultural Act of 2014, known as the 2014 Farm Bill, enacted February 7, 2014.

Through EQIP, NRCS offers voluntary technical and financial assistance to agricultural producers, including Native American tribes, to reduce salt mobilization and transport to the Colorado River and its tributaries. Within the twelve salinity project areas, producers may be offered additional financial incentives and technical assistance to implement salinity control measures with the primary goal of reducing offsite and downstream damages and to replace wildlife habit impacted as a result of the salinity measures.

In FY 2014, $12.1 million of appropriated EQIP funding was allocated to Colorado, Utah and Wyoming to obligate into new land treatment contracts with agricultural producers in 11 salinity project areas. At the end of August, 2014, approximately $11 million was approved or pre-approved for new contracts.

New Projects, Activities and Investigations

Henrys Fork (of the Green River), Wyoming

The Henrys Fork Project was officially adopted with the issuance of the Record of Decision, June, 2013. $62,000 was obligated into two new contracts in 2014.

West Blacks Fork (of the Green River), Wyoming

An area of some 28,000 acres of irrigated pasture and hayland near Lyman, Wyoming, contribute salt to the Blacks Fork River, tributary to the Green River. While a large portion of the geology contributes little salt, about 10,000 acres may contribute significant amounts of salt from canal and ditch seepage and deep percolation from water applied to fields.

The Wyoming Water Development Commission provided a significant grant to the Austin-Wall Canal Company resulting in a comprehensive plan to modernize the irrigated areas within their service area. NRCS anticipates that, in the near future, the Company will begin replacing

earthen canals with buried pipelines that will provide pressure to operate sprinklers on the irrigated lands. NRCS intends to use its regular EQIP authority to assist producers in the area who want to modernize their irrigation systems. Such improved systems will provide significant salt control benefits.

San Juan Basin, New Mexico and Arizona

The first phase of the "Shiprock Pilot Project" to control salt was completed by the San Juan River Dineh Water Users, Inc. (SJRDWU, Inc.) in 2011. A leaky earthen lateral supplied water to 12 Navajo Nation farmers on 168 acres of cropland. The SJRDWU, Inc. completed the construction using their own resources and a grant from the Bureau of Reclamation. The SJRDWU, Inc. also reserved an eight acre parcel of land and has completed practices to replace wildlife habitat values that were lost due to the pipeline installation.

The NRCS has been actively promoting the use of EQIP to improve the on-farm irrigation systems served by the pipeline. EQIP applications have been received but, to date, no installation has occurred. As salt loading is quite high from agriculture along the San Juan River, it is hoped that this pilot project will encourage and accelerate salinity control. The SJRDWU, Inc. has expressed continuing interest in improving the irrigation delivery and application systems within their service area.

Areas Beyond Current Project Boundaries

In Colorado, about $62,500 of EQIP funds were allocated into four salinity control contracts on 71 acres. These four contracts will control about 136 tons annually at a cost of $51 per ton.

Utah and Wyoming did not obligate any "salinity" EQIP funds outside of project areas.

Even though some relatively high salt loading basins exist in both Colorado and New Mexico, local sponsors have not yet been inclined to pursue a salinity project designation.

Monitoring and Evaluation

Project offices continue to monitor and evaluate the effectiveness and quantity of salinity control, wildlife habitat, and economic performance replacement in order to improve overall performance and management of the program. The program continues to function effectively and economically, though the nominal cost per ton of salt control continues to rise in some areas. When the cost per ton is adjusted for inflation, the current cost effectiveness compares favorably with the projected costs at the time of the adoption of the respective projects.

Inflation Effects on Planned and Applied Costs

NRCS Project	Record of Decision	Cost per Ton EIS/Plan	[1]CPI 2012	[2]FAR 2012
[3]Grand Valley, CO	1977	$12	$45	$32
L. Gunnison, CO	1982	$42	$117	$54
Uintah Basin, UT	1982	$69	$189	$62
Big Sandy, WY	1987	$18	$36	$20
Price-San Rafael, UT	1993	$39	$72	$41
Mancos, CO	2004	$53	$64	$131

[1]Consumer Price Index
[2]fixed @ 6.625% for 25 years
[3]page 1 of "On-Farm Program for Salinity Control –SCS-1977, does not include technical assistance.

The Monitoring and Evaluation Reports for FY 2013 can be found on the World Wide Web at http://www.usbr.gov/uc/progact/salinity/index.html.

Status of Planning and Implementation

USDA-NRCS is providing technical and financial assistance to landowners and operators to implement on-farm salinity control measures in eleven approved project areas in three Upper Basin states.

Table 1 – Active Salinity Control Projects

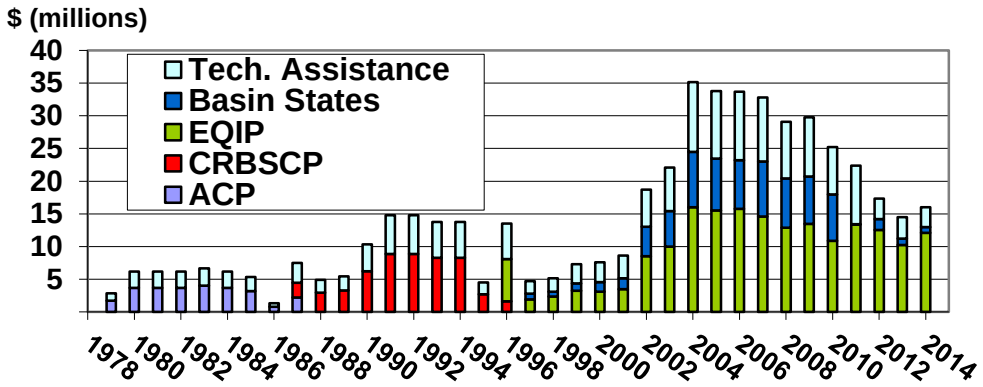
Project Area			
State	Project	(Potential Irrigated Acres)	USDA Servicing Office
Colorado	Grand Valley	50,000	Grand Junction
	Lower Gunnison River	171,000	Delta and Montrose
	McElmo Creek	29,000	Cortez
	Mancos River Valley	11,700	Cortez
	Silt	7,400	Glenwood Springs
Utah	Uintah Basin	226,000	Roosevelt, Vernal
	Price/San Rafael Rivers	66,000	Price, Castle Dale
	Muddy Creek	6,000	Castle Dale
	Manila-Washam	8,000	Vernal
	Green River	2,600	Price
Wyoming	Big Sandy River Henrys Fork	18,000 20,700	Rock Springs Lyman
	Total	**616,400**	

Program History

Progress in implementing the various projects is controlled primarily by annual appropriations, supplemented with funds from the Basin States Parallel Program. From the 1970s through 1986, the Agricultural Conservation Program (ACP) administered by the Agricultural Stabilization and Conservation Service (ASCS) provided financial assistance (cost share) to land users through long term agreements (LTAs) and the Soil Conservation Service (SCS) provided the technical assistance to plan, design and certify practice implementation. From 1987 through 1996, the Colorado River Basin Salinity Control Program (CRBSCP) received dedicated annual funding, again with the ASCS administering the financial assistance and SCS providing the technical assistance. In 1995, Public Law 103-354 authorized the reorganization of several agencies of USDA. The ASCS was reorganized as the Farm Service Agency. The SCS was reorganized as the NRCS. Financial administration of the CRBSCP was transferred to the new NRCS where it has remained to the present.

The Federal Agricultural Improvement and Reform Act (FAIRA) of 1996 (Public Law 104-127) combined four existing programs including the CRBSCP into the newly authorized EQIP. In FY 1997, Reclamation began on-farm cost sharing from the Basin States funds that would parallel and supplement the EQIP.

Figure 1 – On-farm/Near-farm Allocations



As of August, 2014, NRCS obligated and expended about $13.3M of Farm Bill appropriations (EQIP FA and TA) to new EQIP contracts with salinity control measures in Colorado, Utah, and Wyoming. An additional $3.5M of discretionary Conservation Technical Assistance (CTA) funds were expended in the pre-EQIP activities and to service prior year contracts.

Grand Valley, Colorado

Implementation has been underway in this unit since 1979 and NRCS considers that the salt control measures of the project have been successfully completed as planned. In 2010, a status report was compiled from field visits and observations. The report indicated that at least 12,000 irrigated acres are no longer in agricultural production. Of the remaining 44,700 acres still in production, 42,435 acres or 95 percent had received varying levels of treatment.

As of August 2014, one additional contract has been approved but several more should be completed by the end of the fiscal year, September 30.

While the Grand Valley project has been very successful in reaching its salt control goal, the wildlife replacement goal remains to be met. Approximately 400 acres of additional habitat replacement got underway in 2014 and one additional EQIP wildlife project was approved on 18 acres.

Lower Gunnison Basin, Colorado

This project, which began in 1988, encompasses the irrigated farmland in the Gunnison and Uncompahgre River valleys. With the expansion into the upper headwaters of the Uncompahgre River in 2010, implementation continues in Delta, Montrose, and Ouray Counties. Nearly 60 percent of the salt control goal has been achieved.

Interest remains high in the project area with hopes that the findings of the Lower Gunnison Comprehensive Plan will increase applications. Nearly $3.8M was obligated into 47 new contracts with plans to control an additional 3,205 tons of salt on 2100 acres.

Mancos River, Colorado

This project, near the town of Mancos, Colorado, was initiated and approved for funding and implementation by USDA-NRCS in April 2004. Currently, 58 contracts have been developed with EQIP and Basin States Program funds. Four new contracts for $41,701 were developed in 2014 for 36 tons of new salt control.

McElmo Creek, Colorado

Implementation was initiated in this unit in 1990. Application of salinity reduction and wildlife habitat replacement practices continue to be implemented in this area with sprinkler systems, underground pipelines, and gated pipe being installed. In 2014 contracting activity increased significantly as 26 new contracts were developed on 646 acres that will provide 961 tons of salt control when fully implemented. The new systems are about equally split between improved surface systems and sprinkler systems. The project has attained slightly over 60 percent of its salt control goal.

Manila-Washam, Utah

Three new contracts were developed in 2014; one serviced by the Lyman, Wyoming Field Office and two from the Vernal Field Office. These three contracts will control about 463 tons on 198 acres for a cost of about $228,000.

Uinta Basin, Utah

Implementation began in this unit in 1980. The original salt control goal was reached several years ago but about 60,000 acres might still be improved. Producer participation is exceeding the original projections. As of late August, there were 36 new contracts reported. These contracts obligate about $1.6M to control about 900 tons of salt.

Price-San Rafael, Utah

This project obligated more contracts than other projects in Utah. The cost per ton continues to be very cost effective compared to other projects. In August, 2014, 36 new contracts were either approved or pre-approved for a sum of about $3M. When implemented, these measures will control about 4,800 tons on 1,658 acres. The installation of the next phase of the Cottonwood Creek Irrigation Company's pipeline projects is generating significant applications for the EQIP.

Muddy Creek, Utah

There were no new contracts in the project in 2014.

Green River, Utah

There were no new contracts in the project area in 2014. NRCS is actively involved through other authorities in rehabilitating the major diversion structure across the Green River that was damaged in 2012. The successful completion of the construction may spur on-farm applications in future years.

Big Sandy River, Wyoming

Implementation has been underway in this unit since 1988. Approximately 13,600 acres of the planned 15,700 acres have been treated (87 percent) and about 70 percent of the salt control goal has been reached. Producers also report that the water savings from improvements in irrigation systems now allows a full irrigation season of water for the entire irrigation district. In 2014, there were two new contracts on 132 acres for $135,000.

Table 2 – USDA Salinity Control Unit Summary

Table 2. USDA Salinity Control Unit Summary							
			Thru 2014				
Unit	[1]Controls (tons)	Goaled (tons)	Percent of Goal	Costs (FA+TA)	Annualized Costs	Projected total cost	[2]Cost/ton
Mancos River, CO	**4,408**	**11,940**	**37%**	**$6,977,280**	**$578,417**	**$18,899,438**	**$131**
Muddy Creek, UT	**99**	**11,677**	**1%**	**$185,523**	**$15,380**	**$21,882,344**	**$155**
Manila-Washam, UT	**9,986**	**17,430**	**57%**	**$8,075,983**	**$669,499**	**$14,096,173**	**$67**
Silt, CO	**2,233**	**3,990**	**56%**	**$4,301,918**	**$356,629**	**$7,686,813**	**$160**
McElmo Creek, CO	**28,447**	**46,000**	**62%**	**$23,871,557**	**$1,978,952**	**$38,601,315**	**$70**
Uinta Basin, UT	**156,099**	**140,500**	**111%**	**$119,043,706**	**$9,868,723**	**$107,147,648**	**$63**
L. Gunnison, CO	**117,146**	**186,000**	**63%**	**$82,933,232**	**$6,875,165**	**$131,678,257**	**$59**
Price/San Rafael, UT	**99,280**	**146,900**	**68%**	**$52,403,339**	**$4,344,237**	**$77,538,784**	**$44**
Grand Valley, CO*	**143,419**	**132,000**	**109%**	**$59,517,433**	**$4,933,995**	**$54,778,664**	**$34**
Big Sandy, WY	**57,661**	**83,700**	**69%**	**$13,722,528**	**$1,137,598**	**$19,919,453**	**$20**
Green River, UT	**658**	**6,540**	**10%**	**$272,543**	**$22,594**	**$2,708,862**	**$34**
Henrys Fork, WY	0	6,540	0%	**0**	**0**	**0**	**n/a**
Totals	**619,436**	**793,217**	**78%**	**371,305,042**	**$30,781,188**	**$494,937,752**	**$50**
[1]Includes Off-farm funded with EQIP or Basin States funds, not selected thru BOR FOA							
[2]Cost per ton based on amortization over 25 years at 6.625% interest.							
Updated October 20, 2014							

Environmental Protection Agency
Colorado River Basin Salinity Control Program
Fiscal Year 2014

During Fiscal Year 2014, EPA continued to provide coordination and assistance to the Colorado River Basin Salinity Control Forum and Advisory Council involving salinity control activities. Several key items;

- The renewed Colorado River Basin Salinity Control Advisory Council Charter was signed by the EPA Administrator on September 12, 2014.

- EPA provided informational updates to the Forum and Advisory Council including updated State and Tribal Water Quality Standards and related program information.

- EPA Region 8 has assumed the lead role for EPA Regions 6 and 9 for coordination with the Forum and Advisory Council and continues to be available for responding to questions, requests, and other needs.

- EPA Water program staff, including permitting staff from the three EPA Regional Offices, provided updates and input to the workgroup preparing the 2014 Review of the Water Quality Standards for Salinity in the Colorado River System.

- EPA continues to participate as a Cooperating Agency in the Bureau of Reclamation's effort to prepare an Environmental Impact Statement for the Paradox Valley Salinity Control Unit. The Regional Salinity Control Coordinator as well as Underground Injection Control program and National Environmental Policy Act staff are actively participating in this important effort.

The attached table indicates the current status of all the Colorado River Basin States in adoption of the Colorado River Basin Control Forum's salinity standards (Policies and Plan of Implementation).
EPA has approved the applications of five Tribes within the Colorado River basin for "treatment in a manner similar to a state" (TAS) to administer the Water Quality Standards (WQS) and §401 Certification programs on their respective tribal lands, and four tribes have approved WQS. Specifically;

• The WQS for the **Ute Mountain Ute Tribe** were approved by EPA Region 8 on October 19, 2011. The Tribe has salinity and selenium standards and has several on-going selenium and salinity projects examining potential effects on groundwater, irrigation and endangered species in Tribal and downstream waters.

• The **Hualapai Tribe** adopted revised WQS in July 2009, including the 2008 Forum Policies and Plan of Implementation. These revised standards were approved by EPA Region 9 September 25, 2009.

• The **Navajo Nation** adopted revised WQS in May 2008 that included the 2005 Forum Policies and Plan of Implementation; the revised WQS were approved by EPA in March 2009. They have developed draft WQS that refer to the 2011 Forum WQS and conducted their public process on this revision but have not yet completed their action to adopt.

• The **Hopi Tribe** included the 2005 Forum Policies and Plan of Implementation in WQS revisions which were adopted by the Tribe March 21, 2011, and approved by EPA August 24, 2011.

• The **Havasupai Tribe** received its TAS approval on April 26, 2011; EPA Region 9 is working with the Tribe in completing development of their WQS.

The adopted and approved WQS for the four Tribes have been published and are available for review on-line.

COLORADO RIVER BASIN SALINITY CONTROL STANDARDS UPDATE
Basin States Adoption of Salinity Standards & Plan of Implementation Updates
September 2014

EPA Region – State	2005 Update Adopted* by State	2005 State Adoption Approved by EPA	2008 Update Adopted* by State	2008 State Adoption Approved by EPA	2011 Update Adopted* by State	2011 State Adoption Approved by EPA
R9 – Arizona	Yes - 12/02/08	Yes – 1/21/09	In draft	--	In draft	--
R9 – California	Yes – 2/01/06	Yes – 3/16/06	Yes – 8/04/09	Yes – 3/09/10	In draft	--
R9 – Nevada	Yes – 9/06/06	Yes – 4/05/07	Yes - 10/05/10	Yes – 6/15/11	Yes – 10/11/12	Yes – 2/12/13
R8 – Colorado	Yes	Yes	Yes - 12/08/08	2005 adoption reaffirmed	Yes – 12/12/11	2008 adoption reaffirmed
R8 – Utah	Yes – 10/22/08	Yes – 9/30/09	Yes - 10/22/08	Yes – 9/30/09	Yes – 4/1/12	Yes – 11/20/12
R8 – Wyoming	Adopted by reference – Water Quality Rules and Regulations (1982)					
R6 – N. Mexico	Yes – by reference in WQS	Yes	Earlier version not changed	April 2011	Earlier version not changed	Previously approved with adoption by reference

* Adopted/Approved – Some states chose not to adopt Forum Standards during previous review periods because the salinity standards had not changed significantly.

Fish and Wildlife Service
Colorado River Basin Salinity Control Program
Fiscal Year 2014

The U.S. Fish and Wildlife Service (Service) salinity coordinator attended salinity work group and forum meetings during the past year in Phoenix, AZ, Salt Lake City, UT, Jackson Hole, WY, and will be present at the upcoming forum and workgroup meeting in Santa Fe, NM. She represented the Service at most Paradox Valley Unit cooperating agency meetings. She anticipates continued involvement with the assessment of past and future wildlife replacement efforts, as well as involvement with the environmental review of salinity control projects.

Environmental Review of Salinity Control Projects

Sheep Creek Irrigation Company Cedar Hollow Lateral Salinity Control Project and depletions

The Service salinity coordinator assisted the Cheyenne, Wyoming Ecological Services office in the review and preparation of comments addressing the draft Environmental Assessment (DEA) for the Sheep Creek Irrigation Salinity Control Project Cedar Hollow Lateral. A conference call regarding depletions associated with salinity control projects was held on 04/14/2014. Participants included: Tom Chart, Kevin McAbee, Angela Kantola (Colorado River Recovery Program, Lakewood, CO); Barb Osmundson (USFWS Grand Junction, CO), Nathan Darnall (USFWS Cheyenne, Wyoming), Betsy Herrmann, (USFWS SLC, Utah); Kib Jacobson, Bradley Parry, Nancy Coulam, Beverly Hefferman (USBR SLC, Utah), Brent Uilenberg, Terry Stroh, Ted Dunn, Jenny Hamilton, John Sottilaire, (USBR Grand Junction), Kerry Schwartz, Benjamin Radcliffe (USBR Provo, Utah); Travis James (NRCS SLC, Utah). Notes from this call were compiled by Barb Osmundson (USFWS Grand Junction, CO).

Concerns included inconsistencies between US Bureau of Reclamation (Bureau) offices in Grand Junction, Provo, and Salt Lake City, regarding how analysis of depletions associated with salinity control projects are treated in environmental documents, as well as inconsistencies among US Fish & Wildlife Service (Service) field offices in Colorado, Utah, and Wyoming in their environmental response documents sent to the Bureau.

The Henry's Fork EIS prepared by Wyoming Natural Resource Conservation Service (NRCS) discussed an associated depletion of 1,372 acre-feet caused from increased consumptive use of crops associated with installation of the salinity control project. Water budgets showed that improving irrigation systems in the Henry's Fork salinity control unit will create a new net depletion of Colorado River water due to increased forage productivity and associated evapotranspiration. Decreased consumptive use of phreatophytes associated with original seepage was subtracted from increased consumptive use of crops to yield the final calculated depletion: (37,799 AF new -30,361 AF original=7438 AF increase in consumption use of crops) minus (6147 AF original -81 AF new=6066 reduction in phreatophyte consumptive use) =1372 AF new depletion.

The Environmental Assessment for the Sheep Creek Irrigation Company Cedar Hollow Lateral Salinity Control Project estimated that piping the lateral would reduce water lost through seepage by up to 30%, and it is stated that this water saving will make more water available for irrigation. When this was read by Service staff, they were unsure if this would result in a new depletion. It was never explained in the document what would happen to the water savings. Increased irrigation could potentially be associated with increased yield of crops and associated consumptive use of water by crops (like the Henry's Fork). Within the EA was a no effects determination for threatened and endangered species as required by section 7 of the Endangered Species Act (ESA). The Service staff responded that the EA did not provide enough information to determine whether or not there was a new depletion. A new depletion would have resulted in a may affect, likely to adversely affect determination similar to Henrys Fork. A noted difference here is the Sheep Creek EA is an off-farm irrigation project, unlike the Henrys Fork.

The Service has determined that all water depletions from the upper Colorado River basin may adversely affect the Colorado River endangered fish species. Therefore, section 7 consultation is required for all Federal actions that cause or authorize any water depletions that are not included in previous Section 7 consultations. Based on the 1993 Agreement on Section 7 consultations among Colorado River Recovery Program participants, all consultations have relied on the Recovery Programs to off- set adverse effects to Colorado River endangered fish. Water depletions above the confluence with the Gunnison River fit under the Colorado River Programmatic Biological Opinion (PBO) if they meet the following criteria: 1) Private parties must sign a Recovery Agreement (Federal Agencies do not sign) to receive assurances from the Service for prohibitions of take associated with their depletions, 2) New depletions over 100 AF per Year-pay a depletion fee (2014 fee is $20.24/AF). Historic (prior to 1988) depletions and new depletions < 100 AF have no fee, 3) Re-initiation stipulations are included in all consultations, and 4) The Federal Agency agrees to retain discretionary Federal authority.

For the Colorado River below the Gunnison River confluence and all portions of the Green River (except the Yampa Basin), consultation requirements are determined based on the amount of average annual depletion from the basin. Depletions less than 100 AF fit under an Intra Service Biological Opinion (BO) that exempts the depletion fee, though section 7 consultation is still required. New depletions over 100 AF require individual BOs, and have a depletion fee. Historic depletions > 100 AF may require individual BOs, but there is no depletion fee. New depletions > 4,500 AF (the sufficient progress threshold) require individual BOs, a depletion fee, and RIPRAP action implemented. Water depletions in the Gunnison River and Yampa River fit under the Gunnison and Yampa PBOs respectively, and are handled in a similar fashion. The Gunnison River PBO already addresses impacts associated with new depletions from the Gunnison Basin (up to 3,500 AFY in the North Fork, and up to 22,200 AFY in the Upper Gunnison). It is important to note here that the Service consults on depletions---**not on water rights**. Depletions occur when water use is increased over historic and current use, even if the full water right had not been previously exercised.

Because Federal funding is used for salinity control projects, there is a Federal nexus which requires consultation on historic depletions if operations continue. In the absence of a Habitat Conservation Plan (HCP), Section 7 consultation by a federal agency is the only way to extend take coverage to a non-federal entity. The Grand Junction Bureau office has often been asked to extend coverage for historic depletions to individual landowners through the Sec. 7 agreement. They make the determination that there is no new depletion when: 1) there are no new lands that come into production, and 2) there is no new storage created, so the water either stays in the river, or flows back to the river at the canal end. The Grand Junction Bureau office uses the Colorado's Decision Support System (CDSS) to calculate historic depletions. This system incorporates altitude, crop type, climate, temperature, Blaney-Criddle evapo-transpiration rates, soil type, and most variables associated with water budgets. Historic depletions are associated with each diversion structure.

The recommendation from Service employees is to have more explanation in environmental documents from Bureau offices which better explains what happens to the water savings from reduced seepage associated with salinity control projects. Development of a template where project specific information can be incorporated for each project would be helpful for Service employees. Any calculations that show no new depletions would also be helpful, but the Service acknowledges that depletion numbers are estimates of average annual depletions based on a number of highly variable components—some years these depletions are higher, other years they are lower. Information that would be useful in documenting a determination of no new depletions include: no new land will be irrigated, no new water storage will occur, the growing season will not be extended, there will be no change in crop type (or if change in crops, they will require less water), and no additional water will be applied to existing crops (i.e., to get full water right). If there are reduced river diversions, than state this is so—(hopefully no problem with water rights if this is stated??). If increased tail-water at the pipe-end flows back into the river, then provide this information. The Bureau agreed to better explain what happens to water savings when seepage is reduced by salinity control piping projects in their environmental documents.

The Bureau has suggested that the Service needs to look at the existing NRCS EA's and Section 7 consultations regarding depletions associated with on-farm improvements. The Bureau (Provo office) recalled that for a BA done on the Manila-Washam Salinity Control Project in 2006, the Service concurred with a "Not Likely to Adversely Affect" determination made by NRCS. The Service salinity coordinator reviewed the Manila-Washam Plan and EA completed by NRCS in November, 2006. In the EA, it is stated that "the water budget shows an accretion to the Colorado River system through reduced water diversion, and therefore, the proposed project is "not likely to adversely affect" any of the endangered Colorado River fishes." As long as this is the case, there should be no new depletions. Should it be determined that a new water depletion will in fact occur with any salinity control project, section 7 consultation should be initiated with the Service. Because the Bureau contributes funds to the recovery program, there will be no requirement to pay a depletion fee for Bureau projects that exceed 100 acre-feet per year.

Other EA's

The Service salinity coordinator assisted the Salt Lake City Ecological Services office in the review and preparation of comments addressing the draft Environmental Assessment (DEA) for the Sheep Creek Irrigation Salinity Control Project South Valley Lateral. She was also involved in the review of the draft Environmental Assessment for the Phase II of the Minnesota Canal Piping Project in Delta County, Colorado, and the draft Environmental Assessment for the Bostwick Park Siphon Lateral and the Forked Tongue/Holman Ditch Piping Projects.

Endangered Species Act Section 7 Consultations

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et. Seq.), and the Interagency Cooperation Regulations (50 CFR 402), the Service salinity coordinator prepared biological opinions for the following projects: 1) Phase II of the Minnesota Canal Piping Project in the lower Gunnison SCU, and 2) Roger's Mesa Water Distribution Association Historic Depletions for Gunnison Basin Programmatic Biological Opinion.

Endangered Species Updates

Western Yellow-Billed Cuckoo

An increased need for ESA consultation may occur in the future, if the western yellow-billed cuckoo, a species proposed as threatened, is placed on the endangered species list. A final listing decision is expected this October, 2014. Proposed critical habitat was published in the Federal Register on August 15th, 2014. Comments on the proposed critical habitat rule will be accepted through October 14, and can be submitted online at http://www.regulations.gov. It could conceivably be listed by November of this year.

Critical habitat identifies the geographical areas containing features essential for the conservation of the species. The western yellow-billed cuckoo is a riparian obligate species historically known from parts of the 12 States west of the continental divide; including Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, and parts of Montana, Wyoming, Colorado, New Mexico, and Texas. The yellow-billed cuckoo is a secretive, robin-sized bird that breeds in willow and cottonwood forests along rivers and streams. It appears to require large blocks of dense riparian forested habitat consisting of older trees (typically cottonwood) with a vegetative understory component of shrubs and smaller young trees. It eats primarily large insects such as katydids, caterpillars, and cicadas. Biologists estimate that more than 90 percent of the bird's riparian habitat in the West has been lost or degraded as a result of conversion to agriculture, dams and river flow management, bank protection, overgrazing, and competition from exotic plants such as tamarisk and giant reed grass.

Designation of critical habitat does not affect land ownership or establish a refuge or preserve and has no impact on private landowners who are taking actions on their own

property that do not require a Federal nexus such as through funding, permit, or authorization. Critical habitat designation does require Federal agencies that undertake, fund, permit, or authorize activities that may affect critical habitat are required to consult with the Service to ensure that such actions do not adversely modify or destroy that habitat. Salinity control projects or habitat replacement projects that involve critical habitat of any size or riparian habitat over 12 acres in size (such as non-native vegetation removal) may need to engage in ESA section 7 consultation, which may include surveys for presence of yellow-billed cuckoos. The Service is currently working with NRCS in Grand Junction regarding yellow-billed cuckoo habitat in the wildlife replacement project planned in the Grand Valley Unit, and has conducted surveys this summer at Tilman Bishop State Wildlife Area and Walter Walker State Wildlife Area.

Gunnison Sage Grouse

A final listing decision will be available for the Gunnison sage grouse November 12th, 2014, and critical habitat designation will most likely occur at this time.

Greater Sage Grouse

A decision whether or not to propose listing the Greater Sage Grouse is due at the end of September, 2015.

Wildlife Replacement Activities

Henry's Fork Salinity Control Unit (SCU) Wildlife Habitat Replacement

In the 2013 Henry's Fork Salinity Control FEIS, it was estimated that 800 acres of wetlands may be impacted by irrigation improvements. At that time, 129 acres of on-site replacement were identified as possible. Of these 129 acres of potential habitat improvements, NRCS identified approximately 90 acres improved through grazing and wildlife management, plus removal of invasive vegetation species on 25 additional acres. NRCS anticipated being able to create or enhance wetlands on only14 acres within the Henry's Fork project area. It was acknowledged that replacing 800 acres of wetlands in the Henry's Fork SCU will be a challenge. NRCS has chosen to use the Montana Department of Transportation Wetland Assessment Method (MWAM) for site-scale analysis and mitigation tracking.

In light of this future challenge of replacing such large acreages of wildlife habitat, staffs from NRCS, the Service, Wyoming Game and Fish, and Trout Unlimited have held numerous discussions, dating back to November, 2013. Discussions included identification of potential projects for on-site, off-site, and out-of-kind wildlife habitat replacement. NRCS is currently in the planning stages with Trout Unlimited regarding in-stream improvement projects within the drainage. The value of these types of projects is not well represented by the Montana Wetland Assessment Method. Agency participants considered the possibility of counting in-stream improvement projects as viable wildlife replacement projects within the Henry's Fork SCU. Examples of projects

considered as in-stream improvements include; easements, refuge expansion, in stream flow augmentation, fish barrier construction, fish screen construction, and fish friendly diversions. Logistic challenges of using in stream projects for wildlife replacement that were identified by participants included the following: 1) How to calculate total miles of in-stream habitat improved, 2) How to convert these miles of in stream improvements to project acres for incorporation into MWAM to assess pre- and post-project improvements, 3) How to rank and score in stream improvement projects compared to wetland, riparian, and upland restoration projects, and 4) How to prioritize geographic sites for in stream improvement projects. After numerous discussions, the group developed: 1) a method to calculate project acres for in stream habitat projects: 2) a matrix of ranking criteria to help prioritize projects, and 3) a map of priority areas for in stream habitat projects. Participants are hopeful that the development of these tools will allow the implementation of in stream habitat improvement projects, and in turn add acres to the wildlife replacement goal for the Henry's Fork SCU. It should be noted that if there is ever competition between a wetland project verses an project for wildlife replacement funding, the wetland project will take priority.

Tony Sanchez Wildlife Replacement Project

The Service salinity coordinator accompanied Jim Currier and Steve Woodis (NRCS Montrose office) on a tour of the Tony Sanchez property and pond to assess potential for a wildlife habitat replacement project associated with the lower Gunnison SCU. Approval for this project would enable the project to advance to planning and preparation for approximately 9-10 acres of wildlife habitat replacement credit for the lower Gunnison SCU. This project consists of protecting a 6-acre pond and improving wildlife habitat on private property adjacent to the Uncompahgre River and the pond, just north of Olathe, Colorado. Because no farm ground is associated with this project, NRCS is pursuing the BSP wildlife option. The owner approached NRCS (Montrose, Co office) because he was concerned that the river would wash away the bank separating the pond from the river, and he wanted help in stabilizing the river bank. Because bank stabilization alone would not qualify for any NRCS programs, NRCS explored the idea of combining the bank work along with riparian restoration work. The work would consist of removal of non-native noxious woody species (tamarisk, Russian olive, and Siberian elm) to allow regeneration of native woody species that occur on site. Pole planting of cottonwoods and willows and planting bare root/containerized native tree and shrubs will help speed up establishment of native vegetation. With the bank stabilization project, there will be some reconstruction of a flood plain along with the stream barbs. The flood plain will be stabilized with native woody and herbaceous species found along the river. It is estimated by NRCS that this project would provide about 9 to 10 acres of wildlife habitat that can be counted for replacement goals. The Service called attention to the presence of non-native fish in the pond, and noted that the pond outlets need to be screened, to protect critical habitat for the endangered Colorado River fish downstream in the Gunnison River. Because there are predaceous non-native fish that have been stocked in the pond, the screening of outlet structures will help to prevent escapement and recruitment of non-native fish into endangered fish critical habitat in the Gunnison River downstream of the pond. It will also be necessary to screen the inlet, and have the dike of

sufficient elevation to ensure separation of fish in the pond verses fish in the river. Colorado Parks and Wildlife in cooperation with the Upper Colorado River Endangered Fish Recovery Program, have developed Stocking Procedures (last updated in 2009) for non-native fish introduction in the upper basin drainage. Any project on this property, will need to include procedures that avoid introduction of non-compatible non-native fish species into the Uncompahgre River, and in turn into critical habitat downstream in the Gunnison River. Discussions between Colorado Parks & Wildlife, the Service, and NRCS are ongoing.

Grand Valley Wildlife Replacement Project

The Service salinity coordinator continues to track progress on the Grand Valley Wildlife Replacement Project. According to Colorado Parks and Wildlife, a contractor has been selected for vegetation removal for the Grand Valley wildlife replacement project, and removal activities are expected to start this fall. This project will eventually bring the Grand Valley unit to 100 percent of the concurrent acreage replacement goal, and involves the improvement of wildlife habitat on five properties managed by Colorado Parks and Wildlife (CPW) adjacent to the Colorado River near Grand Junction. Removal of tamarisk, Russian olive, and noxious weeds will allow herbaceous ground cover to be re-established at the properties. The project also includes planting cottonwood trees and willows.

Austin Canal Project Habitat Quality Scores

The Service field office in Cheyenne, Wyoming provided comments to the Provo Bureau office in September, 2013 on the Sheep Creek Irrigation Company Cedar Hollow Lateral Salinity Control Project in Sweetwater County, Wyoming and Daggett County, Utah. The Service suggested that habitat quality scores for the Cedar Hollow Lateral (impacted habitat) should have been higher than what the Bureau assessed. Because of these concerns, the Bureau Provo office staff invited Service staff to tour another salinity control project site this year—the Austin Canal Project site near Fort Bridger and Lyman, Wyoming. Service staff met Bureau staff at the site May 2014, and both agencies prepared their own assessment of habitat quality for the area of impact. These scores were shared between agencies, and a conference call involving staff from both agencies enabled discussion of scoring differences.

A standardized habitat assessment protocol had previously been developed for the basin-wide salinity control program by a Reclamation-Fish and Wildlife Service team, and was last updated in 2013. Eleven criteria were developed to examine aspects of habitat that are essential for wildlife. The first criterion, riparian or wetland habitat type must have a "yes" answer in order to proceed to further evaluation. Each of the remaining 10 criteria should then be scored as to what is appropriate or expected for the specific habitat type being evaluated, and some may need to be adapted to fit the specific project area. Evaluators should have an understanding of the ecological community they are evaluating. For each criterion, the project area will be scored from 1-10, with 10 having the most value to wildlife, 1 having the least value. After all criteria have been evaluated,

the total points are added together. These points are then correlated to a habitat quality score based on percentage. Criteria evaluated include: 1) vegetation diversity, 2) stratification, 3) native species vs. non-native species, 4) noxious weeds, 5) vegetative health/condition, 6) interspersion of open water with vegetation, 7) connectivity to protected habitat, 8) uniqueness of habitat, 9) water supply, and 10) alteration. Evaluations using these criteria can be subjective, depending on the experience of the evaluator. There was scoring differences for some of the criteria between the Service and Bureau, but most important, the overall habitat quality scores were similar for both agencies. Going through this exercise gave the Service a better understanding of how Bureau employees assess impacts, and gave the Bureau a better understanding of Service concerns. Because of the subjectivity involved in using this procedure, it is advised that the same evaluator that conducts the assessment of habitat quality for the impacted site also conducts the assessment of habitat quality for the wildlife replacement site. Using the same evaluator will avoid observer bias, and help assure that the appropriate amount of wildlife habitat is replaced compared to that lost during salinity control projects.

Field Site Visits

Colorado

Site visits for implemented and proposed wildlife replacement projects began in March this year, and the last site was visited in September. Sites for 5 proposed and 4 implemented wildlife replacement projects were toured this spring and summer by the Service salinity coordinator and Bureau staff. All visited sites occur in the lower Gunnison SCU. These replacement projects involved: 1) non-native vegetation removal, 2) plantings of native vegetation, 3) pond construction, 4) pond bank stabilization, 5) wetland enhancement, and 6) irrigation improvements.

Utah

A tour of Utah wildlife replacement projects proposed and implemented in the Manila-Washam Unit, the Uintah Basin Unit, and the Price-San Rafael Unit occurred July 8-10. The Service salinity coordinator accompanied NRCS staff from Roosevelt and Salt Lake City on site visits. Different projects included creation of wind breaks, pond creation/ expansion plus securing source water, plantings of native vegetation (including pollinator attracting flowers), and fencing.

The Service truly appreciates the efforts of Bureau and NRCS staff to replace wildlife habitat values forgone.

Review of Monitoring and Evaluation (M&E) Reports

In March, the Service coordinator provided comments back to Ed Neilson in the Grand Junction NRCS office after reviewing draft M&E reports written by Frank Riggle about salinity control units in Colorado. These comments were in turn forwarded to the NRCS State Office. Also, the Service coordinator provided comments back to Ed Whicker in

the Roosevelt NRCS office after reviewing draft M&E reports written by Ed and Jim Spencer about salinity control units in Utah.

After review of the NRCS 2013 monitoring and evaluation reports, the Service has assessed the progress of NRCS in replacing fish and wildlife habitat forgone as a result of implementing salt control measures. A table was prepared to evaluate and compare salinity control units (SCU's) to determine whether wildlife habitat replacement is concurrent with the acres of salt control projects completed to date.

The Big Sandy SCU in Wyoming is concurrent with wildlife habitat replacement acres, and the wildlife replacement goal is exceeded by 10 acres. However, it has recently been determined that a 40-60 acre wetland near Eden, Wyoming dried up in the last few years, after the last piping project was completed, and there may need to be additional acres of habitat replacement acquired for the Big Sandy to have concurrent wildlife replacement. The Service salinity coordinator participated on a September 12th conference call involving staff from NRCS, the Bureau, and the Service to discuss this issue. Call participants identified four potential alternatives to remedy the wetland loss. These alternatives will be investigated further. The group also identified the need to conduct a project-wide assessment to determine if other habitat has been lost or gained in order to determine if the project is "concurrent and proportional." Another call is scheduled for November.

For the state of Colorado, NRCS associated with the Mancos Valley and McElmo Creek SCU's has greatly exceeded wildlife habitat replacement goals, and are at 258% and 155% respectively. For the state of Utah, NRCS associated with the Price-San Rafael and Uinta SCU's have exceeded the recently adopted replacement goal of 2 acres of wildlife replacement habitat per 100 acres of salt control projects, at 9.4% and 13.7% respectively. It should be noted here that inventories completed on habitat replacement sites may result in a reduction of acres considered habitat replacement. Major reasons for this issue provided in some of the M&E reports include urban development, changes in land management, and changes in land ownership. To be concurrent with salinity control project implementation and to replace additional habitat replacement acres lost during the life of the salinity control projects, NRCS will need to continue to emphasize habitat replacement as a high priority for the agency.

Salinity control units that are not concurrent with wildlife habitat replacement acres in Colorado include; the lower Gunnison, Grand Valley, and Silt. With the signed contract for the future Grand Valley wildlife replacement project, the Grand Valley is expected to meet and exceed replacement acreage goals and become concurrent. An issue identified with the Silt SCU is that there are only a few landowners that are interested in habitat improvement projects. An issue identified with the lower Gunnison SCU is that only small parcels are currently available for habitat projects. These small projects are complex in planning and habitat enhancement options, and they provide relatively small acreages per project. NRCS has made additional efforts in the Gunnison SCU with wildlife habitat only sign-ups to engage various conservation groups and other Federal and State agencies to accelerate the implementation of wildlife habitat enhancement

projects. An additional 183.2 acres have been acquired in the lower Gunnison SCU this past year. A goal of NRCS is to encourage habitat replacement projects with better connectivity and a longer-term life expectancy.

Those SCU's in Utah not concurrent with wildlife habitat replacement include; Manila-Washam SCU, Green River SCU, and Muddy Creek SCU. The Muddy Creek and Green River SUC's have not really gotten off the ground yet and have little on-farm treatment, and thus no wildlife habitat replacement. The Service encourages NRCS to negotiate potential partnerships with the Forest Service to improve wildlife habitat on the Henry's Fork wetlands located on Forest Service property near Manila, Utah. When a salinity coordinator is hired for the Uinta Basin, perhaps they can explore potential partnerships on wildlife replacement projects with the Ute tribes. The Service will continue to work with NRCS to identify and solve issues connected with wildlife replacement projects, and to help identify potential replacement opportunities. Most of the wildlife habitat replacement projects require time to become fully functional and reach their full habitat potential. For example, it takes a long time for planted cottonwood trees to develop into a mature gallery. Continued follow-up by NRCS is critical to support landowners with project implementation, and to assure that reported program habitat replacement goals are maintained. Any acres lost during the life of the salinity control program will need to be replaced to maintain a concurrent status.

Table 3 – Summary of wildlife habitat replacement in salinity control units for 2012.						
Salinity Control Units	Habitat Acres Acquired in 2013	Habitat Acres Cumulative Total	% Goaled Acres	Total Needed Acres	Remaining Acres Needed to be Concurrent	Comments
Colorado						
Lower Gunnison Unit	183.2	1,191	93%	1,274	83	63,675 salt control acres thus far 115,000 acres full salt control project implementation
Grand Valley	3.8	756	63%	1206 including Debeque & Whitewater	450	Separate negotiated replacement of 1,206 acres 60,000 acres full salt control project implementation, adjusted full potential=42,800 acres, with 41,989 to date or 98% project goal. Contract under way for Grand Valley Wildlife Replacement Project for 490 acres-Implementation will exceed goal by approx.. 40 acres
Mancos Valley	None	137	258%	54	None	To date 2695 acres salt control 5400 acres full salt control project implementation
McElmo Creek	None (5 planned)	451	155%	290	None	To date, 14,608 acres 21,550 acres full salt control project implementation
Silt	None	19.4	72% concurrent 39% full	40 riparian/upland 10 wetland	8 for concurrent 31 for total	Only a few landowners interested in wildlife habitat To date 1510 acres salt control, 2800 acres full salt control project implementation
Utah						
Green River	None	None	None	41.6 with full implementation	2	In 2012, only 1 contract for salt control on 96 acres 2080 acres full salt control project implementation Local landowners balancing need to buy energy for pumping for sprinkler systems. No economical gravity pressure.
Manila-Washam	None	9	12.5%	72	63	7780 acres full salt control project implementation. To date, 3600 acres salt control

Table 3. cont'd. Summary of wildlife habitat replacement in salinity control units for 2012						
Price-San Rafael	None planned. 1,038 acres applied at Hatt Ranch	1,981 Wetland 1,118 Upland 3,100 total	About 500%	None	None	Problem with enough staff to do M&E of habitat replacement projects 45,000 acres full salt control project implementation To date 30,600 acres salt control
Salinity Control Units	Habitat Acres Acquired in 2013	Habitat Acres Cumulative Total	% Goaled Acres	Total Needed Acres	Remaining Acres Needed to be Concurrent	Comments
Utah (cont'd)						
Uinta	17acres planned & funded 187 acres applied	21,300 (16,748 Upland, 4,504 Wetland)	675%	None	None	160,000 full salt control implementation To date 157,700 acres salt control
Muddy Creek	None	None	None	121	121 with full project implementation	Project hasn't taken off the ground yet. Lack of off-farm irrigation infra-structure is impeding the creation of on-farm grant opportunities 6050 acres full salt control project implementation
Wyoming						
Big Sandy	None	860	100+ ??	???	???	As of 2013, Habitat replacement goal exceeded by 10 acres. To date, 13,077 acres treated for salt control. It has recently been discovered that more wetland habitat may be needed to meet replacement goal.

U.S. Geological Survey (USGS)
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2014

The USGS conducts a variety of science activities to assess salinity conditions in the Colorado River, guide program management decisions, and to determine the effect of salinity control efforts. These activities are conducted in cooperation with the Colorado River Basin Salinity Control Forum (CRBSCF) and in support of Federal resource management agencies including the Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), and the Natural Resources Conservation Service (NRCS). In addition, activities and accomplishments in USGS National programs such as the National Streamflow Information Program (NSIP) and the National Water-Quality Assessment (NAWQA) Program provide valuable information to Salinity Control Program (SCP) agencies. These SCP science-support activities and relevant USGS National program activities (described below) range from data collection in a basin-wide monitoring network, to research on the fate and transport of salt at various scales.

Colorado River Basin Monitoring Network and Basic-Data Collection

The USGS monitors salinity at 20 key stream sites (stations) in the Colorado River Basin extending from near the headwaters to the Mexican border. Salinity data at the 20 stations are used to assess compliance salinity-level criteria and also track salinity trends as related to salinity control work. Specifically, the program of water-quality monitoring consists of three levels: (1) monitoring for evaluation of individual salinity control measures, (2) stateline monitoring, and (3) monitoring for determination of annual average flow-weighted concentration in the lower main stem.

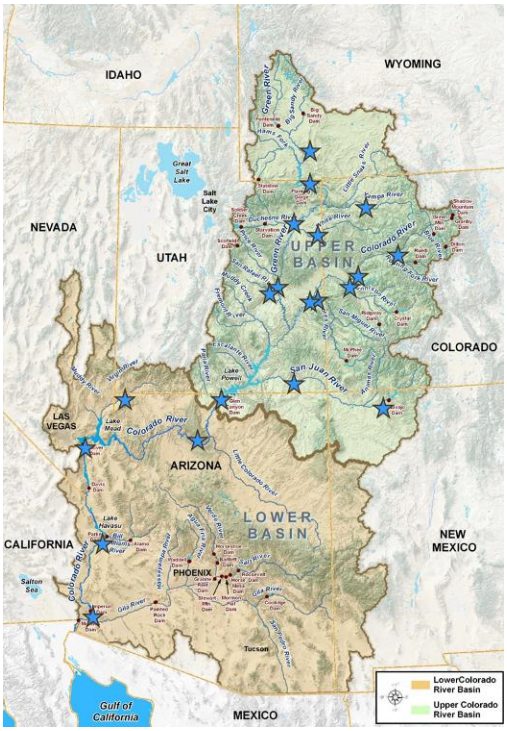


Figure 2 – Location of monitoring sites in the 20 station network.

The Reclamation-developed planning model, known as the Colorado River Simulation System or CRSS, incorporates data from the monitoring network to simulate both flow and salinity throughout the Colorado River Basin. Each year the USGS computes continuous and monthly total dissolved solids (TDS) concentrations and loads based on data gathered at the 20-station network using the USGS SLOAD model.

In 2010, the USGS began evaluating new methods to model and deliver monitoring data from the 20-station network including estimated salinity load. During mid-term Reclamation model simulations, water-quality results in the CRSS model were substantially impacted by initial

model conditions, which included salinity concentrations downstream of major reservoirs such as Lakes Powell and Mead. New modeling methods that provide more timely salinity concentration data would reduce uncertainty in CRSS model predictions. The USGS in cooperation with Reclamation and the CRBSCF has developed a process to serve real-time salinity estimates, based on SLOAD model results, on the World Wide Web.

Figure 3 – USGS gage – Green River near Greendale

To provide these real-time estimates, historic data were used to develop regression models that estimate concentrations for salinity at 20-station network sites. At a minimum, data from discrete measurement of salinity concentration, streamflow, and specific conductance at each of the sites were needed for model development. The regression models can estimate continuous concentrations or loads on the basis of continuous specific conductance or streamflow data. Real-time load estimates for the 20-station network are available on the USGS National Real Time Water Quality Web Site, http://nrtwq.usgs.gov. A USGS Open-File Report "Regression Models for Estimating Salinity and Selenium Concentrations at Selected Sites in the Upper Colorado River Basin, Colorado, 2009–2012" has been published and is available http://pubs.usgs.gov/of/2014/1015/.

Documenting the Effects of Grazing on Sediment, Water, and Salinity Production from Mancos Shale soils – Badger Wash (BW), Colorado

The BW study area provides a unique opportunity to assess impacts of domestic grazing on run-off and erosion processes of the Mancos Shale. The study area has 8 paired watersheds (ranging in size from 12 to 107 acres); with one of each pair fenced in 1953 to exclude domestic livestock and the other open to grazing. The area has been grazed by domestic livestock since the late 1800s, primarily by cattle but early settlers grazed sheep extensively. In arid and semi-arid ecosystems, overgrazing often results in decreased vegetative cover, increased soil compaction, and breaking up of stabilizing soil crusts, leading to increased run-off and erosion. Such changes to hydrology and erosion are of particular concern for soils derived from saline parent material (such as Mancos Shale) due to potential negative impacts on in-stream water quality. Since 2006, the USGS has used the grazing treatments and subsequent variability in soil and vegetation attributes to address basic questions related to soil and hydrologic processes on the Mancos Shale.

Activities in 2014 continue to be focused on collecting the data needed to facilitate using the variability in soil quality, biological soil crusts, and vegetation present at the BW to evaluate, and if needed, calibrate existing run-off and erosion models for Mancos Shale. To this end, we have

continued to sample and maintain approximately 80 silt fences distributed across all 4 paired watersheds that measure hillslope-scale erosion. We have installed two new weirs and stilling wells (for a total of 4 instrumented weirs) that measure sub-watershed scale runoff. We also have continued to collect samples and monitor in-stream water quality in two watersheds (we have had 8 events thus far in 2014). We have also been compiling the data and GIS layers and, in collaboration with the ARS at Walnut Gulch, completed the ground work that will enable us to run watershed scale run-off and erosion models at BW and compare those values to measured results (collected currently and by Lusby previously).

Analysis and preparation of previously collected data has continued in 2014. Specifically, we have discovered that exclusion of domestic grazers in BW watersheds has resulted in only slight differences in vegetation cover (slightly higher perennial grass cover) but do differ significantly in soil quality attributes. Cover of biological crusts and aggregate stability are significantly higher and soil compaction significantly lower in ungrazed areas. These results, combined with the observed higher run-off and erosion rates observed in the grazed areas, further emphasizes the need for run-off and erosion models that account for soil quality when considering land-use impacts on Mancos Shale Ecosystems.

Mineralogical Controls on Salinity and Related Elements Impacting the Pariette Draw (PD) and Wetland, Utah

The Utah Division of Water Quality determined that PD is in violation of water quality criterion for total dissolved solids (TDS), selenium (Se) and boron (B) due to nonpoint contamination. Daily loads of contaminants have been characterized, but little is known about the impact of bedrock and soil mineralogy on salt storage and the water-rock interactions that control mobility of salt and high concentrations of Se and B. Studies in the Uncompahgre River watershed in Colorado by the USGS show that salt derived from weathering shale in a semi-arid climate is stored in a variety of minerals that contribute solutes based on a complex set of conditions. Selenium and B commonly reside in salt phases, so knowledge of the behavior of salt sheds light on the behavior of associated contaminants.

Land managers, including the BLM, must decide whether or not the salt, Se, and B contaminants in the watershed can be managed, and what sustainable mitigation strategies are possible. To accomplish this, knowledge about the source, cycling, and transport of contaminants throughout the watershed and the effect of land-use practices is critical. The USGS, in cooperation with the BLM, Reclamation, and the Utah Department of Environmental Quality are finishing a study that is providing the geological, mineralogical, and geochemical data needed to model these processes in the watershed. This model can then be used to answer questions ranging from viability of contaminant control to strategic mitigation design. During the study, the USGS collected samples at sites that weather under natural and irrigated condition. Samples include soil profiles from cultivated and the natural landscape, rock from the formations that crop out in the watershed, and surface- and groundwater from streams, ponds, springs, and auger holes. A subset of sites was sampled multiple times throughout the year to determine potential seasonal and irrigation effects on nonpoint contamination. Data have been compiled for samples collected in 2011 and used to construct working hypothesis regarding the residence of contaminants and

changes related to pedogenesis, contaminant transport, and land use. Data for samples collected in 2012 will be used to test these working hypotheses. A USGS Open File Report documenting this work is in preparation.

Hydrogeologic Characterization of Paradox Valley and evaluation of alternatives for salinity reduction for the Paradox Valley Unit, Montrose County, Colorado

Figure 4 – Paradox Valley

Paradox Valley in western Colorado is a collapsed salt anticline, where groundwater flow processes have led to the dissolution of salt deposits and the development of a highly concentrated brine plume in the central part of the valley. The Dolores River, a tributary to the Colorado River, flows across the axis of Paradox Valley and acts as a groundwater discharge location. As such, the Dolores River experiences substantial increases in salinity as it intercepts the brine, with historical (1988-1995) salt loads estimated to range from about 95,000 to 205,000 tons per year. Under the Colorado River Basin Salinity Control Act, Reclamation constructed and operates a salinity control project, the Paradox Valley Unit (PVU) to reduce salinity loads to the Dolores River. The project consists of a series of shallow pumping wells designed to intercept the brine before it flows into the river and an injection well that disposes of the produced water in deeper geologic formations. The injection well system is nearing the end of its useful life, and Reclamation is exploring alternative strategies to reduce the salinity loads to the Dolores River. Possible future mitigation alternatives to be assessed include: (1) reducing recharge on the valley floor through modification of surface-water impoundments and (or) watercourses, and changing irrigation practices, and (2) managing (increasing) the stage of the Dolores River in the valley to decrease the groundwater gradient and flow between the aquifer and the river. The USGS is assisting Reclamation in these efforts through the development of conceptual and numerical groundwater flow and transport models and supporting hydrogeologic characterization.

<u>Airborne Geophysical Data Processing and Interpretation for Paradox Valley</u>

One major component of the supporting characterization of the Paradox Valley is the processing and interpretation of previously collected airborne geophysical data. The USGS contracted airborne electromagnetic (AEM) surveys over Paradox Valley in 2011. The AEM method used in these surveys characterizes the electrical resistivity of subsurface materials to depths up to 250 m. Variations in electrical resistivity are highly sensitive to variations in the concentration of total dissolved solids in groundwater, small percentages of which can dramatically decrease bulk resistivity. Resistivity is also sensitive to the presence of clay or other conductive minerals and to variations in water content and grain-size distribution. The sensitivities of AEM method to changes in total dissolved solids and lithologic composition make resistivity-based

interpretations ideal for defining the shallow geometry of the brine plume and refining the geometry of hydrostratigraphic units in freshwater regions of the valley. The objectives of the present study are to: (1) evaluate the AEM data, (2) develop and execute appropriate AEM data processing and inverse modeling schematics, and (3) develop interpretations of the brine plume geometry and surrounding subsurface geology. The AEM interpretations are intended to provide constraints for the USGS groundwater modeling effort.

In 2014, the USGS completed the evaluation of the AEM data, noise-processing schematics, and initial contractor-performed inversions (a modeling process that develops an interpretable subsurface resistivity structure from the AEM data). A USGS Open-File Report publicly releasing the contractor-provided data has been prepared and is in review. We have chosen the processing schematic and resulting dataset that best represents the very conductive nature presented by the brine plume and will most accurately represent Paradox Valley. New inversions of the AEM dataset have been performed using a stochastic approach, which allows more statistical evaluation and quantifiable interpretation of the AEM data than possible using the contractor's initial smooth inversions. These stochastic inversions have been used to interpret the freshwater-brine interface using a combination of: (1) theoretical relations between groundwater total-dissolved solids concentration, fluid resistivity, formation porosity, and bulk electrical resistivity, and (2) geologic background resistivity values in the freshwater regions of Paradox Valley. This interface has been provided to the USGS groundwater modeler (Ken Watts) and is currently being used to define the initial brine-plume geometry in the numerical groundwater flow modeling effort.

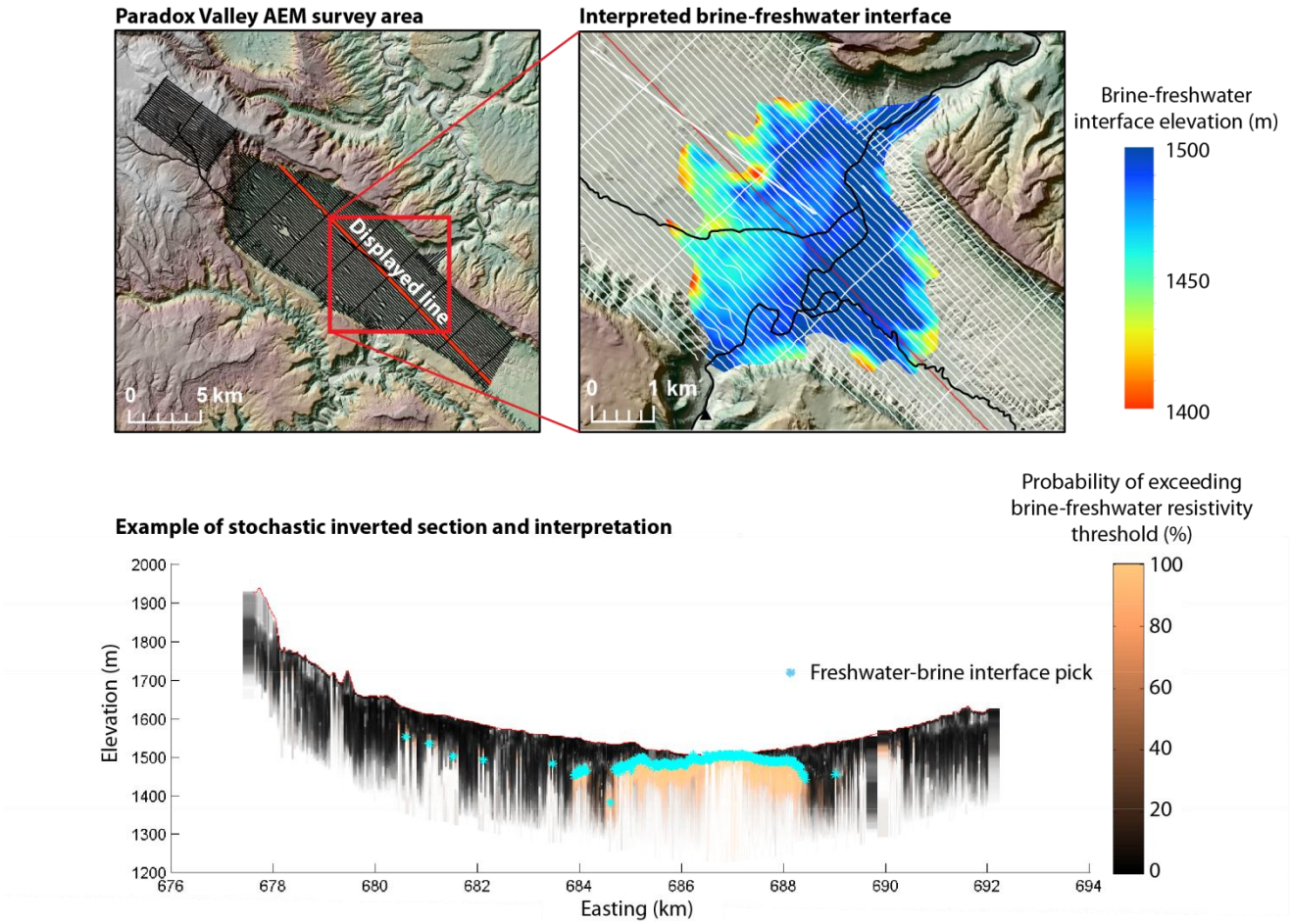


Figure 5 – Example of the development of the freshwater-brine interface using the inverted airborne electromagnetic data from Paradox Valley

Beginning in October 2014, the USGS plans to develop new inversion models using a least-squares approach to develop best-fit resistivity models of the Paradox Valley AEM study area. These models will be used to continue work on the broader geologic interpretations of the Paradox Valley AEM data to provide: (1) an improved understanding of the regional subsurface geology, (2) refinement to the shape of unconsolidated deposits near the Dolores River, and (3) additional evaluations of the freshwater-brine interface. Publication of the freshwater-brine interface and geologic interpretation is planned by October 2015.

Groundwater Flow Modeling and evaluation of alternatives for salinity reduction

The USGS has completed a study developing conceptual and numerical computer models of the Paradox Valley groundwater flow system to aid in the evaluation of potential alternatives for salinity reduction. A better understanding of the hydrogeology, the spatial and temporal distribution of recharge, groundwater flow, dissolution of salt, and stream-aquifer interactions will allow for the assessment of potential hydrologic responses to proposed salinity control alternatives.

To increase the amount of quantitative data to support modeling, the USGS conducted a three month aquifer test in the spring of 2013, utilizing existing Paradox Valley Unit brine-production wells and nearby monitoring wells. Monitoring wells were instrumented with sensor-transducers to monitor changes in water levels and temperature. Small-diameter tubes were attached to transducers to permit collection of water samples at various depths within the monitored wells. Samples were collected before, during, and after the test to evaluate vertical distribution of fluid density and specific conductance within the wells. Pressure transducers were installed at existing conductance monitoring sites in the Dolores River to monitor stream stage and water temperature. Analytical and numerical models were used to analyze the aquifer-test data to determine hydraulic properties of the aquifer and effects of the position of the freshwater-brine interface on brine discharge to the river. Results from this test and preliminary interpretations of AEM survey of the depth to freshwater-brine interface have been incorporated into the numerical model.

Calibration of the three-dimensional numerical model indicated that temporal variations in brine discharging to the Dolores River primarily are related to variations in infiltration of water (irrigation return flow and conveyance losses) in the western part of the valley, and to seasonal variations in stage of the Dolores River. This suggests that water-management operations that reduce freshwater heads and hydraulic gradients in the alluvial aquifer could affect discharge of brine to the river. The processes and parameters that control these responses, however, are complex. The USGS is currently testing scenarios to reduce salt load discharged to the Dolores River in Paradox Valley.

Statistical Modeling (SPARROW and LowGunS) Applied to Assessing the Distribution of Salinity Loads and Load Sources in Streams of the Colorado River Basin

Modeling tools: The USGS has developed two models to assess the distribution of salinity loads in surface waters and sources of those loads in the UCRB: (1) The Upper Colorado River Basin SPARROW (Spatially Referenced Regressions on Watershed Attributes) model and (2) The Lower Gunnison River Basin Water-Quality model (LowGunS). These models represent the surface-water flow system at basin and sub-basin scales and are based on conceptual models that relate observed loads in UCRB streams to up-basin physical characteristics including elevation, precipitation, geology, land cover, and land and water use. Both models estimate salinity load and load sources and can be used to improve SCP managers' and planners' understanding of the salinity-load balance and to prioritize and optimize SCP resources toward efficient and cost-effective control projects.

Model estimates are currently being used by SCP participating agencies to meet a variety of information needs. Work continues, however, to enhance the accuracy and utility of these models as part of SCP science planning.

Upper Colorado River Basin salinity modeling tools -SPARROW 2.0: The development of the USGS Upper Colorado River Basin SPARROW model (UCRB SPARROW model) was motivated by the need of SCP managers for improved understanding of the spatial distribution of

salinity sources, load accumulation, and transport mechanisms in the UCRB. The objective was to develop the best possible tool that would allow managers to better understand and estimate load distribution and yield to streams in any area of interest, even if little or no data were available for that area. The UCRB SPARROW model provides that tool by relating measured transport at monitoring stations to upland catchment attributes including contributing upstream reaches, and extrapolating those relations to un-monitored catchments.

Predictions of dissolved-solids loads are now available for more than 10,000 stream reaches of the stream network defined in the UCRB. From these estimates, the downstream accumulation of dissolved solids, including natural and agricultural components, can be examined in selected rivers. A USGS Scientific Investigations Report documenting the modeling effort was published in May 2009. A web-accessible interactive map also was developed and populated with input and output data from the study. The report and the interactive map product are available at http://pubs.usgs.gov/sir/2009/5007/.

Because the current UCRB SPARROW model is receiving heavy use in a variety of roles as a management tool, program managers have been interested in enhancing the model and maximizing its utility for program assessment and management. The current UCRB SPARROW model has several significant limitations that can now be addressed to a degree by applying recently-gathered data and evolving GIS methods. Current model load estimates represent conditions in water year 1991. The year 1991 was chosen for model development and calibration, in part, due to the relative abundance of streamflow and water-chemistry data available for the UCRB for that year. Salinity control program managers, however, are frequently interested in salinity load distribution under long-term average climatic and hydrologic conditions. Salinity loads observed at monitoring sites in 1991, incorporated into the SPARROW model, were below average throughout most of the basin. Although control program managers have devised several methods to adjust 1991 model estimates to meet their needs, they are interested in revising the model to represent nearer-to-average flow and loading conditions, and to incorporate current land-use and water-use data including the effects of salinity control projects on irrigation practices.

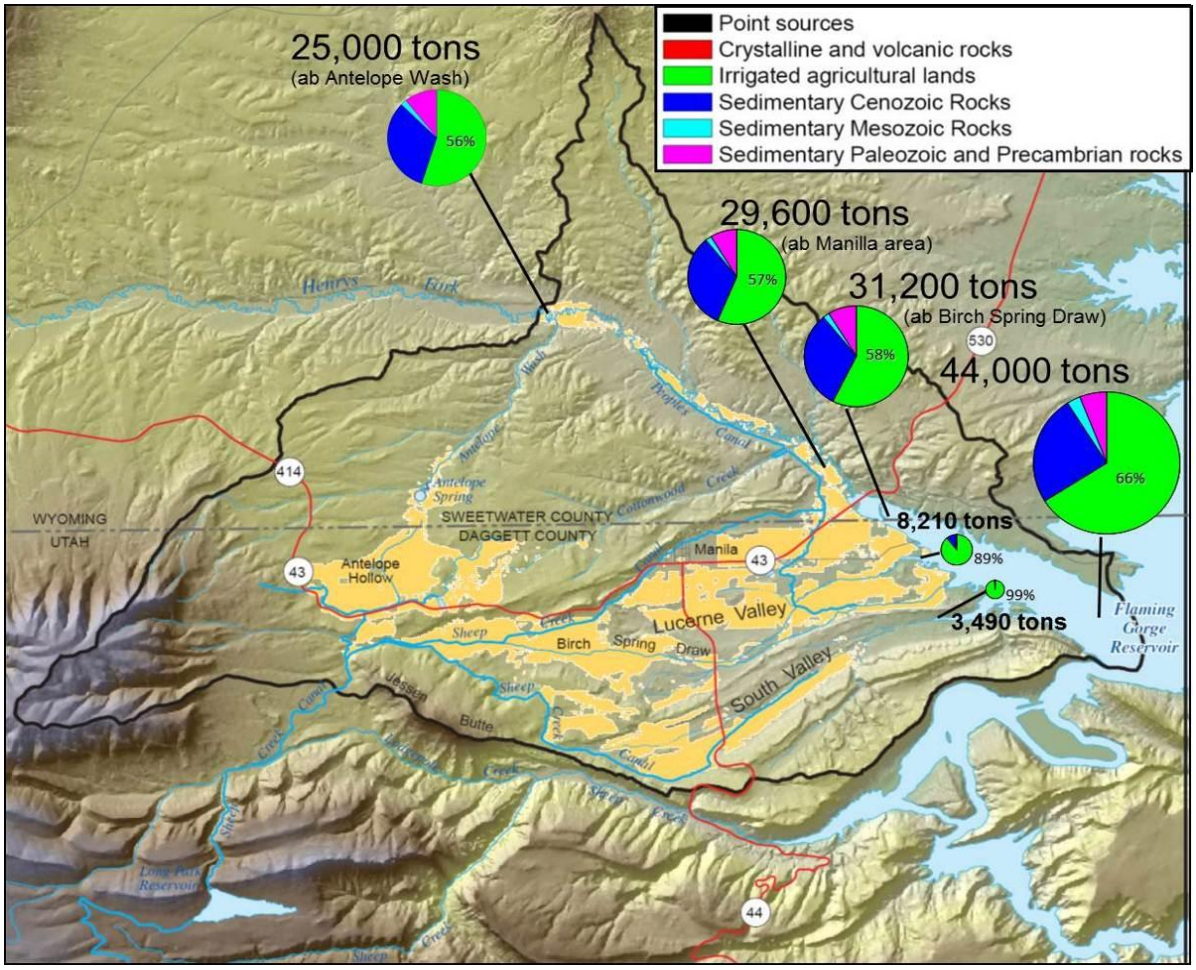


Figure 6 – Example of USGS 1991 UCRB SPARROW model output - Estimated annual salinity loads by load source at Henrys Fork, near the Utah Wyoming border.

The 1991 UCRB SPARROW model is also limited in its representation of irrigated lands. Model development and calibration indicated that the presence of irrigated lands strongly correlated to downstream salinity loads. The data incorporated in the 1991 SPARROW model, however, did not differentiate among irrigation methods which can greatly affect the amount of unused irrigation water available to transport salts to streams.

In 2013, the USGS completed two activities to support the future update and enhancement of the UCRB SPARROW model: (1) development of a new water-quality data set from a subset of active USGS gages in the UCRB, and (2) development of a geospatial model describing irrigation status, including irrigation method, in the UCRB. Water year 2013 was the last of 4 years of monitoring to augment water-quality data from existing USGS gages in the UCRB and increase the number of data sites where salinity load could be computed and used during calibration of an updated UCRB SPARROW model. In water year 2013, water-quality data were collected at 76 gaging stations in the UCRB including 38 gages in Colorado, 18 in Utah, 12 in Wyoming, 7 in New Mexico, and 1 in Arizona. The USGS has also completed development of a

geospatial data set containing a spatially consistent and accurate definition of where irrigation is occurring in the UCRB and the method of irrigation. A summary of the geospatial model is provided later in this report.

In 2014, the USGS began development of an updated UCRB model referred to as SPARROW 2.0. Modeling will build on the geospatial basin characteristic data sets and modeling approaches developed for the 1991 SPARROW model with emphasis on providing estimates of salinity load in the UCRB that reflect the current level of salinity control on irrigated lands under long-term streamflow conditions. Work to date has included the synthesis of historic streamflow and water-quality data, including the augmented data collection conducted in water years 2010–2013, into new estimates of flow-adjusted salinity load for use in model calibration. A USGS Open-File Report, "Updated Estimates of Long-Term Average Dissolved-Solids Loading in Streams and Rivers of the Upper Colorado River Basin" has been published documenting that effort and is available at http://pubs.usgs.gov/of/2014/1148/. The USGS continues to work closely with Reclamation scientists and engineers to maximize the SPARROW model utility toward the enhancement of future Reclamation salinity transport models, including providing estimates and predictions of agricultural and natural salinity loading to the CRSS model.

Mapping irrigated lands and irrigation type in the Upper Colorado River Basin

Irrigation in arid environments can alter the natural rate at which salts are dissolved and transported to streams. Delineating irrigated agricultural lands in the arid lands of the UCRB and differentiating between flood and sprinkler irrigated land is important to help refine existing dissolved-solids loading and transport models. Accurate maps of irrigated agriculture and irrigation practices can also help focus and prioritize salinity control efforts by more precisely identifying areas where water quality may be impacted by irrigation and agricultural practices.

Agricultural lands in the UCRB have been mapped at varying temporal and spatial resolutions by UCRB states (Colorado, Utah, and Wyoming) and by Federal agencies (Bureau of Reclamation and U.S. Department of Agriculture). Most agricultural land maps include field boundaries and crop type information. The boundaries are mapped at varying spatial resolution and precision using an assortment of techniques and information sources. Colorado and Utah maps include information about irrigation type but are incomplete in some areas and the methods used to determine irrigation type varies. In addition, data in these maps are from different time periods.

In 2013, the USGS completed a synthesized regional map of irrigated agricultural lands in the UCRB incorporating information from available state and Federal mapping efforts. The product is a temporally and regionally consistent dataset of irrigated lands in the UCRB. The new tool can be used as a baseline dataset to monitor agricultural land use and assess irrigation practice in to the future, to improve understanding of dissolved-solids loading from irrigated lands, and to improve regional estimates of water use. Its immediate use, however, will be as a component of the updated UCRB SPARROW Model (SPARROW 2.0) for estimating salinity loads and loads sources in UCRB streams.

The mapping project was completed in two phases conducted over the course of 3 years. Phase 1

was conducted as a proof of concept and methods development phase and was completed in 2011. During phase 1, GIS, photogrammetric, and remote sensing techniques were used in conjunction with existing datasets to map and classify agricultural parcels for a single time period in a small study area. The results of the pilot project were used to finalize techniques used to map the larger basin.

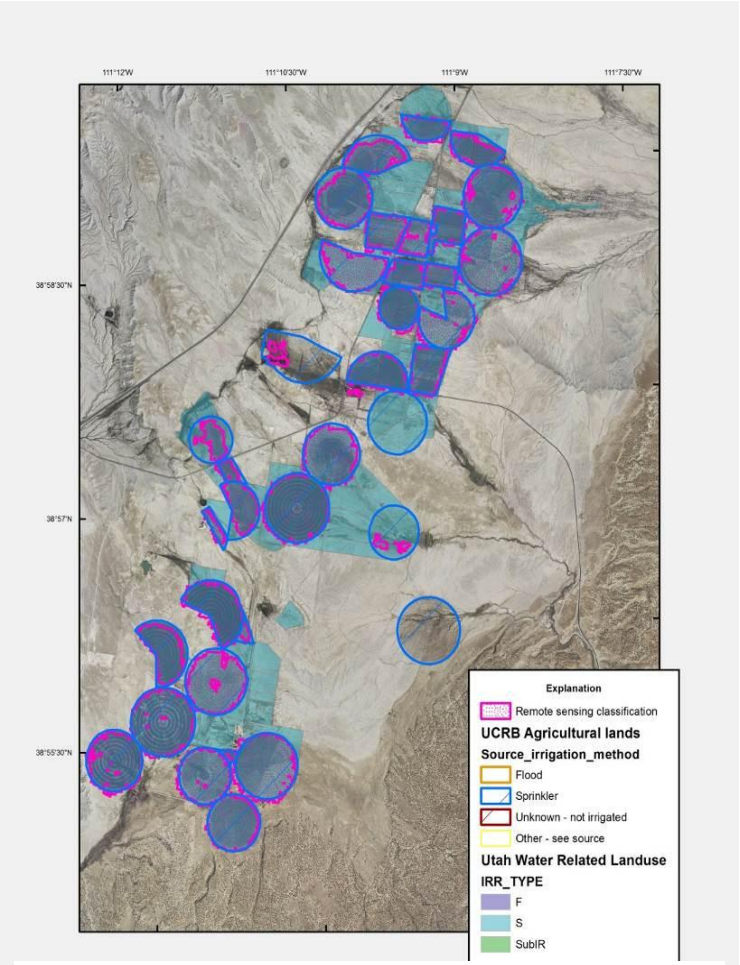


Figure 7 – Example of results of remote sensing classification to determine irrigation status, UCRB

Phase 2, completed in 2013, focused on mapping the status of UCRB agricultural lands using techniques developed and refined during phase 1. Mapping is based on 2007–2010 National Agricultural Imagery Program (NAIP) data for the UCRB and on 30-meter Landsat satellite data acquired over a similar time period. The NAIP imagery is used to refine the boundaries of the existing datasets, to digitize new boundaries where necessary, and to determine irrigation type. Landsat data were used to determine irrigation status of each parcel for the period from 2007 to 2010.

The results of the mapping effort and analysis of land-use and irrigation-practice changes are documented in a USGS Scientific Investigations Report "Development of a regionally consistent geospatial dataset of agricultural lands in the Upper Colorado River Basin, 2007–10" published in 2014 (http://pubs.er.usgs.gov/publication/sir20145039) completing the project. Irrigated lands data are published as a digital GIS dataset and have been released on the USGS Water Resources node of the National Spatial Data Infrastructure.

Ranking Subbasin Salinity Loads in the Lower Gunnison River Basin

The USGS, in collaboration with Reclamation, is using the LowGunS model to define a ranking of subbasins (by tons of salinity load) in the Lower Gunnison River Basin (LGRB), which will allow for objective, informed targeting of subbasins for salinity control projects and will provide information to estimate the cost per ton of salinity removed from the system by off-farm salinity control projects.

Work has been conducted in two phases with the following tasks:

Phase I

1. Update and enhance the existing LowGunS model for use as a ranking tool

    - Incorporate improved GIS information for canal and lateral locations (GIS spatial data sets to be updated by Reclamation and not included in the funding request)
    - Incorporate improved irrigation method codes contained in the 2000 irrigated land spatial data set (irrigation codes to be provided by NRCS and Colorado River Water Conservation District)
    - Review and revise model algorithms to improve utility and accuracy at different scales
    - Update model with results of recent field work and studies

2. Rank subbasins by tons on the basis of results from the updated LowGunS model

Phase II - Augment monitoring in high-ranked basins

The results of the ranking exercise will be used to locate high priority areas (cost effective areas for salinity control as determined by Reclamation). This ranking process is especially useful for data-poor areas that otherwise would have limited justifications for priority salinity control efforts. Sampling for salinity and streamflow will be done in areas that were data poor and ranked as a high priority for salinity-control projects.

A report documenting the model updates has been completed and was published October 2013. A USGS report documenting the ranking study can be found at: http://pubs.er.usgs.gov/publication/sir20135075.

The SCP partially funded additional LowGunS modeling efforts for salinity loading in the Lower Gunnison River Basin (30k) as a means to improve existing Hydrologic Identifier (HIDs) ranks. These funds, in conjunction with funds from the State of Colorado, will be used to improve the geospatial representations of physical features used to model salinity loads. New layers such as perched ponds and septic system location and size will also be explored. In addition to improving the geospatial component of the model, the USGS will develop the LowGunS model such that the existing loading cap for salinity is met and a temporal component is included. These modifications exist to meet a new requirement by Reclamation to provide more consistent salinity loading estimates now and in the future for use in the Reclamation Funding Opportunity Announcements (FOAs). The temporal component is intended to make the LowGunS model better represent salinity loads prior to the onset of salinity control efforts, yet be flexible enough to represent more current conditions when geospatial layers are updated. If the LowGunS model tracks accurately through time, there may be potential to run simulations of the effects of future land use and salinity control efforts.

Lower Gunnison River Basin Well Inventory

A recent study conducted by the USGS in the Smith Fork region of the LGRB indicates that groundwater may play a large role in salinity loading to main stem rivers. Results from the study suggest that there may be an under accounting of salinity loads in the LGRB because groundwater processes have not been properly characterized. These groundwater processes may also explain discrepancies between loading rates calculated as part of the Smith Fork region study and salinity models calibrated for the LGRB. Local irrigation entities are requesting that Reclamation further investigate this issue.

Historically, the general sampling strategy in the LGRB is to sample surface waters and arroyos that drain agricultural areas. Little to no groundwater data were collected as part of previous salinity investigations with the exception of the Reclamation well network that was established for the East Uncompahgre Valley 'water and salt budget'. There are also other sources of groundwater information that exist in the LGRB that were not originally associated with salinity investigations. These data can largely be sourced from the USGS, the State of Colorado, and Reclamation.

In 2013, USGS analyzed available well data and information to improve the understanding of the groundwater system in the Smith Fork region and the contribution of groundwater to salinity loading in streams of the LGRB. Results of the assessment indicate that, in some areas, salinity load that is generated from irrigation agriculture in an incremental catchment of the Smith Fork region may be transported by groundwater to a significant distance downstream of the irrigated-lands source area before returning the stream system.

In 2013, a network of 30 groundwater monitoring wells was installed on the east side of the Uncompahgre River Basin as part of the Reclamation Selenium Management Program. This network will be sampled during the irrigation and non-irrigation seasons of 2014–2015. Salinity samples will be collected as part of this effort. This and previous groundwater information compiled for the Lower Gunnison River Basin (including water-level mapping past and present) will be published in a USGS report in 2016. The information may be used to further calibrate the SPARROW or LowGunS models.

Analysis and Preservation of Historic NRCS Monitoring and Evaluation Work in the Grand Valley and Other Areas of Western Colorado (1985-2002)

The NRCS assessed deep percolation and estimated salt loading derived from irrigated agricultural lands in the Grand Valley in a 1985 to 2002 monitoring and evaluation study, hereafter referred to as "NRCS M&E". That assessment provided a baseline of deep percolation characteristics on agricultural land, and has been used by NRCS to make management decisions related to salinity reduction projects.

The NRCS M&E data have never been made public. The data were released internally to the NRCS in a series of annual reports from 1985 to 2003. In 2012 and 2013, the USGS worked with the NRCS to characterize NRCS M&E and evaluate the data set, along with documenting

the methods utilized in collecting the data. A regression analysis was also completed to examine the M&E data with regards to using site parameters to predict irrigation efficiency and deep percolation of irrigation water.

The USGS presented the results of the study to the SCP Science Team and Work Group in the summer of 2014 and has completed a report documenting the effort that is currently in peer review. The report is scheduled to be published by December 2014.

Effects of Urbanization on Salinity and Selenium Loading in Montrose Arroyo, Western Colorado

Since 1993, an estimated 75 percent of agricultural lands have transitioned to urban land in the lower portion of the Montrose Arroyo subbasin, with most of the transition occurring after 2000. A previous USGS study documented, on a site-specific basis, a decrease in water use and deep percolation associated with the conversion of agricultural lands to urban land use. This project has revisited Montrose Arroyo to determine, on a watershed level, the effects of urbanization on salinity loading. The Montrose Arroyo study has assessed the integrated effects of multiple types of land-use change, including the conversion of previously unirrigated land to residential use on salinity and selenium loading to area streams. The study was designed to produce information that could be used to help understand what the future effects of residential growth will be on salinity levels in the Uncompahgre Valley.

Specific activities included:

- Collecting bi-monthly (six samples per year) water-quality data through two irrigation water years (April 2008 through March 2010) at the three sites on Montrose Arroyo sampled in previous studies
- Quantifying areas of urban development that have occurred since 2000 using GIS data and data from other sources
- Estimating changes in salinity loading (trends upward or downward) using instream data and comparison to historical instream data

Data collection was completed for this study in March 2010 and a USGS Scientific Investigations Report documenting the effort was published in 2011. The report is available at http://pubs.usgs.gov/sir/2011/5106/.

Data presented in the report indicate there was

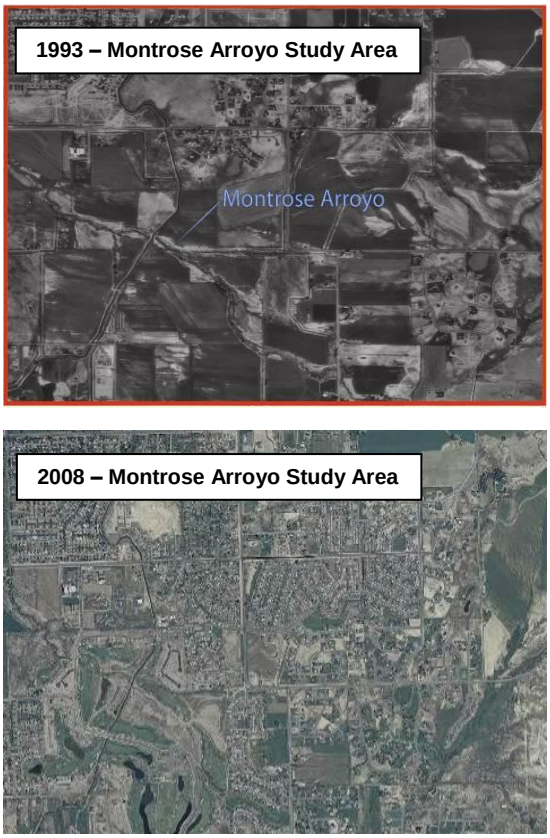


Figure 8 – 1993 and 2008 Montrose Arroyo Study Area

little to no change in salinity levels in Montrose Arroyo prior to and after residential development. Based on these results, it was proposed that additional sampling near other possible salinity load sources including an 18-hole golf course be conducted to determine if that area, or other sources, may be offsetting any decreases that might have occurred as a result of residential development.

Beginning in October 2012, a second phase of the Montrose Arroyo study was initiated including sample collection at the previous monitoring sites and at one additional site. The new site has historical data for use in comparing pre- and post-land conversion water-quality conditions in the middle section of the Montrose Arroyo study reach. Data collection for phase II was completed in 2013 and a USGS series report documenting the study effort will be published in early 2015. Preliminary findings indicate decreasing trends in salinity in some areas of Montrose Arroyo where land use has been converted from agricultural land to residential. Results are still mixed at the mouth of Montrose Arroyo where salinity levels have decreased somewhat, but are still quite variable. This condition at the mouth of Montrose Arroyo may be due to the type of land use conversion that has occurred which includes a relatively new 18-hole golf course and large acreage estates.

Investigation of Transport of Dissolved Solids Discharged from Pah Tempe (La Verkin) Springs, Southern Utah and possible remediation of salinity load to the Virgin River

Figure 9 – Pah Tempe Spring, Washington County, Utah

Pah Tempe Springs discharge substantial amounts of dissolved solids (salt) to the Virgin River, which are transported downstream and contribute to the salinity of the Colorado River. Consequently, these salts affect the suitability of water in the LCRB for agricultural, industrial, and domestic uses. Studies conducted in the 1970s and 80s determined that desalinization of the water discharged from Pah Tempe Springs is technically feasible. However, the reduction in dissolved solids that would have been realized in the Colorado River from this type of project was less economical, at the time, than other proposed projects and involved several uncertainties. Consequently, the project was not implemented.

During 2007-08, the USGS in collaboration with the SCP conducted a preliminary assessment of the transport of dissolved solids from Pah Tempe Springs downstream to below Littlefield, Arizona. This first-phase study was conducted to provide managers with information needed to determine if they should proceed with a more rigorous and comprehensive assessment of the Pah Tempe Springs salinity load and the development and consideration of possible remediation scenarios. Results of the Phase-I investigation, which utilized longer data record periods than the previous studies, indicated that flow and salinity loads in the Virgin River Basin were substantially different during 1992-2006 than those reported for the period prior to 1971 and concluded that removal of salts discharged from Pah Tempe Springs could result in a larger reduction in dissolved-solids loads in the river at Littlefield, Arizona, than was previously

estimated by Reclamation.

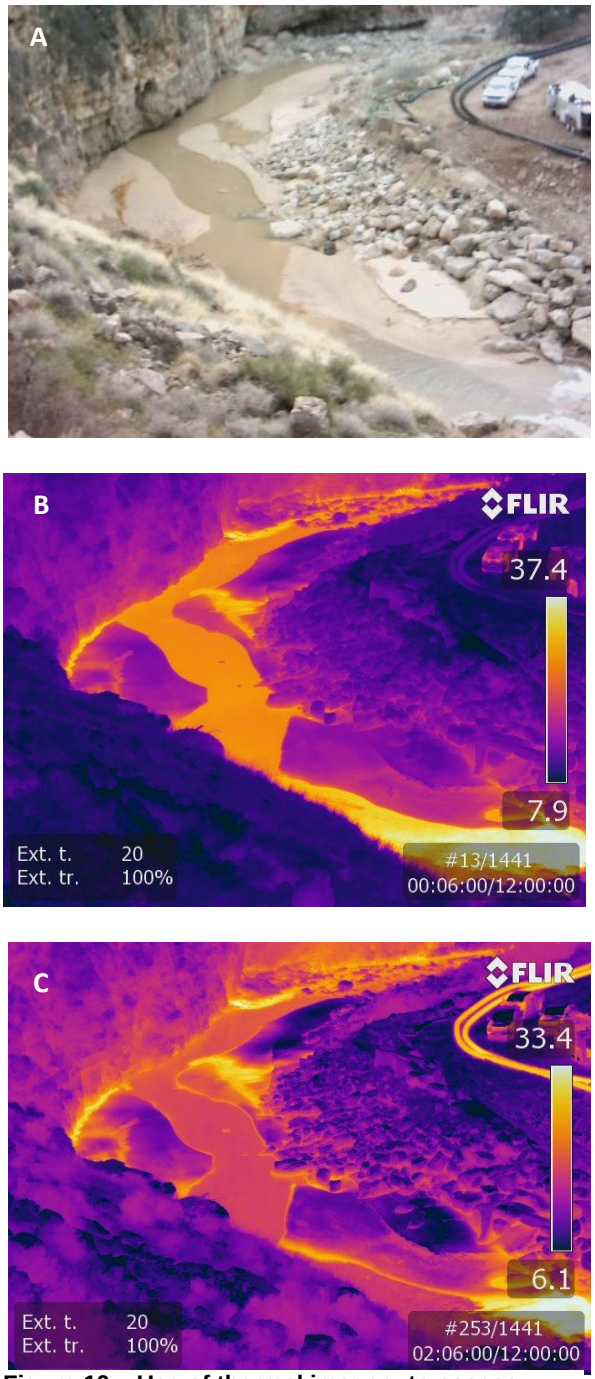


Figure 10 – Use of thermal imagery to assess changes in temperature (as a surrogate to salinity load) in the Virgin River during Pah Tempe Springs pump tests: (A) Photo of part of the study reach impacted by direct Pah Tempe Springs discharge, (B) Pre-test thermal image of same reach (displayed temperature range is in degrees C), (C) Thermal image after pumping has started (pipeline transporting pumped thermal water can be seen in the upper right in the photo and high temperature area at bottom right of photo is shrinking)

Based on these results, Program managers determined to move forward with a comprehensive investigation (Phase II). The scope of work for this second phase was defined by recommendations resulting from Phase I and included additional assessment of salinity load lost as seepage from the Virgin River and whether that load was returned to the river via Littlefield Springs.

The results of Phase II have been documented in the USGS Scientific Investigations Report "Hydrosalinity Studies of the Virgin River, Dixie Hot Springs, and Littlefield Springs, Utah, Arizona, and Nevada" was published in 2014 and is available at http://pubs.usgs.gov/sir/2014/5093/. Key findings generally confirmed the results from Phase I and indicate that a significant portion of the discharge from Littlefield Springs comes from Virgin River seepage to groundwater and has an apparent travel time from losing reaches of the river to the springs of less than 30 years. The preliminary results imply that a hypothetical reduction in dissolved-solids load in the Virgin River below Littlefield Springs, if Pah Tempe Springs salts were restricted, may be from about 67,000 or 71,000 ton/yr immediately and as high as 90,000 ton/year within 30 years of restriction.

The USGS, in cooperation with SCP, Reclamation and the Washington County Water Conservancy District is now working on two study tasks as part of a third study phase (Phase III) beginning to explore the feasibility of Pah Tempe Springs load mitigation scenarios and the effects of mitigation on downstream Virgin River flow, chemistry, and ecology.

One potential approach to reducing the Pah Tempe Springs salinity load to the Virgin River would include the pumping of thermal water from within the Hurricane Fault damage zone to lower

the groundwater pressure head at spring discharge locations and reduce or eliminate discharge from the springs to the river. The CRBSCF, Reclamation, and local water managers would like to know if this approach is a feasible solution, what level of groundwater withdrawals might be needed to capture a large percentage of saline spring discharge to the river, and what would be the effect of the tested range of withdrawal rates on the quality of the extracted water and on streamflow conditions below the springs in general.

To meet these information needs, the USGS designed experiments to assess the effects of groundwater withdrawal from the Hurricane Fault zone on discharge of saline water from Pah Tempe Springs, and on the flow and quality of water in the receiving Virgin River. Tests were conducted in November 2013 and February 2014 and included pumping from the fault zone and:

(1) Monitoring changes in spring and pumping well discharge, chemistry, and temperature over time and under different pumping and streamflow conditions.
(2) Monitoring changes in streamflow and stream water chemistry within the reach of the river where springs discharge directly to the river.
(3) Monitoring temperature continuously at the study-reach streambed and use heat as a tracer for spring discharge.

A third test is tentatively scheduled for November 2014 to assess the effects of pumping on spring discharge to the river under a high-flow condition. Previous tests were conducted under low streamflow conditions. A groundwater flow model of the fault damage zone has been constructed for use in assessing test results and the utility of applying such a tool to evaluated future diversion and treatment scenarios load mitigation. Study results will aid in understanding the general hydraulic characteristics and properties of the study area fault zone and will allow for assessment of the feasibility and effectiveness of a range of possible pumping scenarios to reduce salinity load to the river. This will allow Reclamation and SCP managers to assess the scope and cost of Pah Tempe Springs salt load mitigation approaches that incorporate groundwater pump-and-treat techniques.

The USGS has also reviewed and evaluated available information that may be used to assess the effects of treating water discharged from Pah Tempe springs to the Virgin River on the distribution of native fish in the river. The Virgin River is home to six native fish species. Two of these species, the woundfin (*Plagopterus argentissimus*) and the Virgin River chub (*Gila seminude*), are federally listed as endangered species. The Virgin spinedace (*Lepidomeda mollispinis*), while not federally listed, was proposed for listing as an endangered species in 1994. As with all organisms, the ability of the native fish of the Virgin River to survive in a given area is dependent on the physical, chemical, and biologic conditions in the river.

Pah Tempe springs is a significant source of hot, salty, low oxygen water to the Virgin River that influences the habitat conditions for native fish species below the springs. While many studies have quantified the abundance, distribution, and habitat requirements of native fish species in the Virgin River, the direct links between changing water quantity/quality conditions and native fish survival in the Virgin River are less clear. Ideally, Salinity Control Program managers charged with assessing the feasibility of mitigating Pah Tempe Springs salinity load and the effects of

mitigation on Virgin River ecology would be able to quantitatively predict how future changes in water quantity and quality conditions in the river will influence native fish survival. Compiled data, described in the USGS Open File Report "Discharge, Water Quality, and Native Fish Abundance in the Virgin River, Utah, Nevada, and Arizona, in Support of Pah Tempe Springs Discharge Remediation Efforts" (http://pubs.usgs.gov/of/2014/1104/) can aid investigators and managers in answering the overarching question, "How will various remediation scenarios to reduce the load of dissolved solids from Pah Tempe springs into the Virgin River influence the distribution and abundance of native fish?"

Monitoring Salt Loads Discharged from the Manila-Washam Salinity Control Project Area, Utah

During 2004-05, the USGS investigated the occurrence and distribution of dissolved solids in water from the agricultural lands near Manila, Utah, determined the amount of dissolved solids being discharged to Flaming Gorge Reservoir, and subsequently reported the results in a Scientific Investigations Report (Gerner and others, 2006; available at http://pubs.usgs.gov/sir/2006/5211/PDF/SIR2006_5211.pdf).

The NRCS began implementing a salt-load reduction project in the Manila-Washam area during 2007 that involved converting flood irrigation to gravity-pressure sprinkler irrigation systems. As part of the project implementation, and in support of future projects, the USGS has monitored the concentration of dissolved solids in selected drains and seeps to observe changes that occur during implementation of the Manila-Washam Salinity Control Project (MWSCP).

The largest discharge of dissolved solids from the MWSCP area is from Birch Springs Draw (BSD). Consequently, a streamgage (USGS site 09230300) was installed near the outflow of BSD in May 2007. Discharge, specific conductance, and the water temperature of BSD streamflow were continuously monitored through water year 2012. Several water-quality samples were collected from BSD to define the relation between dissolved-solids concentration and specific conductance. Discharge and specific conductance or dissolved-solids concentration have been measured periodically at other major drains and seeps discharging to Flaming Gorge Reservoir from the MWSCP area. These continuous and periodic data sets were used to determine the net annual load of dissolved solids discharged from the entire MWSCP area through water year 2012.

Figure 11 – Weir installed by NRCS on Birch Springs Draw for future monitoring of streamflow and water quality.

Completion of the NRCS salt-load reduction project in the Manila-Washam area has progressed at a slower pace than originally expected. As a result, the SCP Science Team recommended discontinuing the full monitoring plan in the area and annual computation of salinity load discharging from the area to Flaming Gorge Reservoir at the end of water year 2012. The SCP Science Team

plans to review options for future monitoring to continue to assess the effects of the MWSCP as it proceeds to completion, including possibly collecting data and estimating salinity loads every 3 years instead of annually.

Per recommendation of the SCP Science Team, the collection of streamflow and water-quality data will continue at the previous USGS gage location at BSD. The NRCS installed a weir at the monitoring site in 2014 and will operate a gage at the site. All flow measurements and water-quality sampling in others parts of the study area will cease for a period.

The USGS has summarized the monitoring effort through water-year 2012 and computed trends in salinity load out of the basin in a Scientific Investigations Report "Dissolved-Solids Loads Discharged from Irrigated Areas near Manila, Utah, May 2007–October 2012, and Relation of Loads to Selected Variables" currently in review. Preliminary conclusions of the investigation indicate that, although salinity loads leaving the study area are affected by variations in water distribution and application, irrigation improvements are reducing loads in the ranges projected by NRCS. The USGS report is expected to be published December 2014.

Rangeland sources of salinity transport - Evaluation of the Effects of Selected Rangeland Conditions on the Sources and Transport of Dissolved Solids Delivered to Streams in the Upper Colorado River Basin

The USGS, USDA, Reclamation, and other member agencies of the Colorado Salinity Control Forum have been working together to further the understanding of dissolved-solids (salinity) sources and transport processes in the Upper Colorado River Basin since the 1970s. While many past studies have focused on irrigated agricultural lands, the overall objective of this study is to improve the understanding of sources and transport mechanisms in rangeland catchments that deliver dissolved solids to streams of the UCRB. An important goal is to gain knowledge about how certain land management practices or land conditions may be affecting dissolved-solids yields to streams, such that changes in the land and water management could be made to reduce dissolved-solids yields.

The study consist of 6 phases, including: (1) a literature review on sources and transport of dissolved solids in rangelands, (2) a synthesis of the literature review, (3) a GIS reconnaissance of the effects of rangeland conditions on dissolved-solids yields, (4) an evaluation of the potential to improve an existing dissolved-solids source and transport model for the UCRB by better accounting for relevant factors in rangelands, (5) an analysis of the relation of dissolved solids and suspended sediment in streams of the UCRB. Phase 6 will document the knowledge gained in phases 1-5, and the resulting report will identify the watersheds that likely contribute the largest dissolved-solids loads to the UCRB from rangelands.

Relationships between the health of rangelands (i.e. state within an Ecological Site) and transport potential of salts identified in this study may reveal where conservation practices can be applied to cost-effectively reduce dissolved-solids yields delivered to UCRB streams. In addition, several of the datasets compiled in this study will be evaluated for incorporating into USGS SPARROW model updates, potentially reducing the uncertainty of these models and providing enhanced

capability of running prediction scenarios that evaluate the effects of different land and water management on dissolved solids in UCRB streams.
Study phases 1 and 2 have been completed by the USDA Agricultural Research Service (ARS). The literature synthesis has produced a bibliography serving as a guide to the scientific literature covering salinity sources, mobilization, and transport from rangelands to river systems, with particular focus on the Colorado River Basin. There are 768 unique citations with abstracts (when available) in this bibliography. Documents cited were published from 1902 through mid-2013. URLs and DOIs (Digital Object Identifiers) are provided for online documents when available. The inclusion or omission of a particular citation does not imply endorsement or disapproval. The draft bibliography "[Draft] Salinity Mobilization and Transport: Hydrologic and Aeolian Processes and Remediation Techniques for Rangelands" can be viewed at http://wqic.nal.usda.gov/draft-salinity-mobilization-and-transport-hydrologic-and-aeolian-processes-and-remediation. A draft summary report "Salinity Mobilization and Transport from Rangelands: Assessment, Recommendations, and Knowledge Gaps" has also been completed.

The remaining study phases are ongoing with tasks now shifting to the USGS. Work is underway, in study phases 3 and 4, compiling geospatial datasets for investigating the effects of rangeland conditions on UCRB dissolved-solids yields for the next SPARROW model. Challenges in theses phases include finding geospatial data that either directly or indirectly address the practice or condition thought to affect dissolved-solids yields defined in the ARS literature synthesis and finding data to cover the UCRB study area. Estimates of long-term salinity loading in UCRB rivers and streams at qualifying monitoring sites have been completed. The new estimated distribution of salinity loads will be compared to geospatial models of rangeland conditions and management practices and will be incorporation into the updated SPARROW model in study-phase 4. These updated long-term load estimates and methods used to obtain them are documented in the USGS report "Updated Estimates of Long-Term Average Dissolved-Solids Loading in Streams and Rivers of the Upper Colorado River Basin" available at http://pubs.usgs.gov/of/2014/1148/.

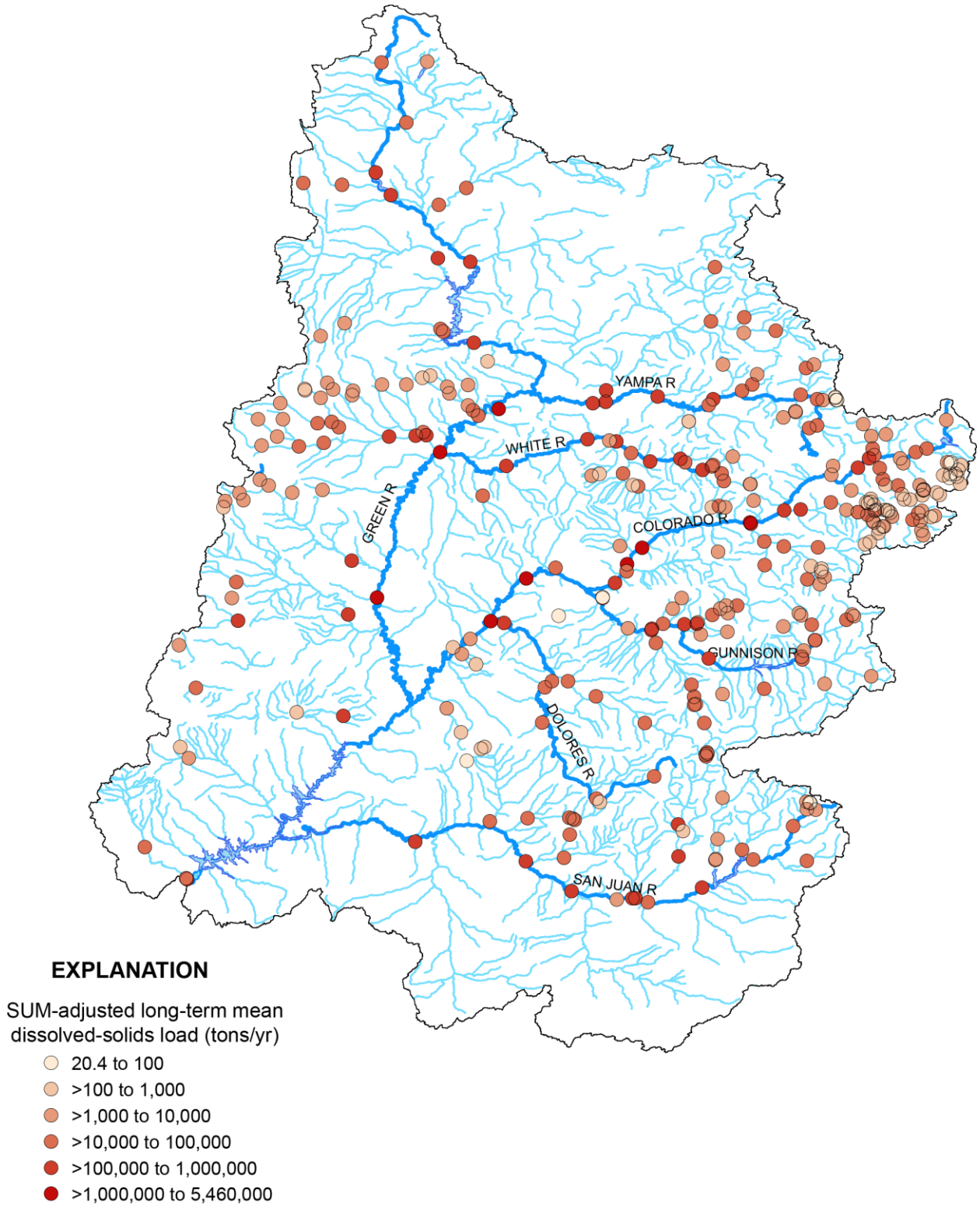


Figure 12 – Map of UCRB sites with estimated long-term mean annual dissolved-solids loading

Many management practices to reduce dissolved-solids loading are based on the assumption that reducing suspended sediment reaching surface waters will reduce dissolved-solids loads to those waters. There have been no published studies, however, to determine if there is a relation between suspended-sediment and dissolved-solids concentrations in rivers. For phase five of the study, the USGS conducted such an investigation on the effect of suspended-sediment concentrations on dissolved-solids concentrations in UCRB streams and rivers. Multiple linear regression was used on streamflow and water-quality data from 164 sites in the UCRB to develop dissolved-solids models that include combinations of explanatory variables of suspended sediment, flow, and time. Results from statistical tests on the models indicate that 68 of the UCRB sites have strong or moderate evidence of a relation between suspended-sediment and dissolved-solids concentrations, with drainage areas for many of these sites composed of a large percentage of clastic sedimentary rocks. Preliminary results of the work have identified ten sites that had strong evidence of an effect of suspended sediment on dissolved solids and had high dissolved-solids yield in the drainage area. These results could assist water managers in the region in directing field-scale evaluation of suspended-sediment control measures to reduce UCRB dissolved-solids loading. Methods, data, and results are discussed in journal article "A data reconnaissance on the effect of suspended-sediment concentrations on dissolved-solids concentrations in rivers and tributaries in the Upper Colorado River Basin" which is awaiting publication in the Journal of Hydrology has completed peer review and the USGS approval process and is awaiting journal acceptance and publication.

Trends in Surface-Water Salinity and the Effects of Salinity Control Projects in the Uinta Basin, Utah

In 2014, the USGS began a study to assess salinity trends in Uinta Basin streams and to quantify the effects of salinity-control projects on salt loads to Uinta Basin surface waters. Specific study objectives include:

1. Assessing trends in salinity load at selected sites in the basin that drain both natural and agricultural-effected landscapes,
2. Apportioning changes in salinity load into agricultural-sources and non-agricultural-sources (natural sources) amounts, and
3. Comparing agricultural amounts determined from trends testing to on-farm and off-farm CRBSCP salinity reduction estimates from Reclamation and NRCS

Available data for all historic and active USGS gage sites in the basin are being reviewed and considered for trend analysis. Qualifying gage sites monitoring catchments where limited or no agricultural land use is occurring (natural sub-basins) will be used to assess trends in loads from natural sources.

The USGS statistical program RLOADEST is being used to estimate daily dissolved-solids load at selected sites. RLOADEST builds linear regression models relating load to streamflow, time,

and season. Trends in the calculated dissolved-solids load at selected sites are being analyzed using the Normalized Regression Method where streamflow for the period of interest is the mean of the daily streamflow values for that period. Flow-normalized dissolved-solids load determined from the mean daily streamflow removes the variability in salinity resulting from variation in streamflow within the multiple regression model.

Observed trends in natural sub-basins will be assessed and extrapolated across the basin to account for the component of trends at all gage sites that are the result of temporal changes in load from non-agricultural sources. This assessment will be aided by an existing USGS SPARROW model of total dissolved solid load for the UCRB and geospatial models of watershed characteristics that were developed during past SPARROW model development. SPARROW model results can be used to estimate the percent load at the selected gage sites from agricultural and natural sources. Geospatial data for the basin defining irrigated lands, compiled during the development of the SPARROW model and refined as part of another USGS project, will be used to help differentiate natural and agricultural source load for each gaged sub-basin.

The results of trends testing will be compared to estimates of off-farm and on-farm salinity reduction resulting from salinity-control projects in the Uinta Basin provided by Reclamation and NRCS or assessed in cooperation with Reclamation and NRCS as needed. The regional comparison will be divided by sub-basins or groups of sub-basins that are defined by the available streamflow-gaging network.

Results of the study will enable CRBSCP Managers, Reclamation, and NRCS to evaluate the effects of salinity-control projects on salinity levels in the Duchesne River and other streams in the Uinta Basin and improve understanding of the effects, if any, that changes in nonagricultural landscape and water use have had on the trends in basin streams. This information can be used to evaluate best practices in salinity control in ongoing and future projects in the basin.

Bureau of Land Management
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2014

The BLM administers about 53 million acres of public lands in the Colorado River Basin above Yuma, Arizona. Substantial portions of these public lands are ecologically classified as arid or semiarid rangelands. Point sources of salt on public lands include saline springs, seeps from marine sedimentary formations, abandoned flowing wells, discharge from abandoned mines, and discharge of waters from authorized activities such as oil and gas production or mining. Nonpoint sources of salt include surface runoff, soil erosion, stream sediments, and groundwater discharge to streams. Salts can be transported either in solution or with solids such as soils or coarse fragments. Past studies have indicated that salt loading in rangelands is closely associated with sediment loading.

Salt concentrations on public lands tend to be highest in areas underlain by marine sedimentary rocks such as shales and mudstones that receive less than 8 inches of annual precipitation. Although salt concentrations can be very high in runoff from these lands, the frequency and volume of runoff is low because of the low precipitation and ephemeral nature of stream systems. Runoff from areas with highly saline soils in the upper basin is estimated to contribute about one-third of the annual salt load from BLM public lands.

The greatest volume of salt contributed from BLM-administered lands, however, is sourced from areas with moderate to low salt concentrations in soils that are relatively well-covered with perennial vegetation and receive more than 12 inches of annual precipitation. Although salt concentrations in runoff from these lands are low, total loading is relatively large because of higher water yields. These areas comprise about 67% of BLM-administered lands in the upper basin. Runoff from these areas is estimated to contribute more than half of the annual salt load from BLM-administered lands in the upper basin.

The BLM is committed to reducing salinity concentrations in the Colorado River sourced from its public lands as required by amendments to the Colorado River Basin Salinity Control Act of 1974 and mission mandates under the Federal Land Management Policy Act of 1976 (FLPMA). The BLM's primary strategy for reducing salt transport to the Colorado River is to minimize erosion from public lands through its existing land-management policies and practices. These policies and practices are intended to maintain or restore land-health as reflected by key ecological attributes such as soil and site stability, watershed function, and biotic integrity.

The BLM manages public lands according to a multiple-use mandate under the FLPMA. Many land-use activities such as livestock grazing, energy development, mining, recreation, timber production, utility transmission, and road management increase erosion and sediment transport. The BLM attempts to reduce these impacts to help maintain land-health standards by utilizing best-management practices; including terms, conditions, and stipulations in land-use authorizations; and requiring actions to restore lands upon completion of authorized activities. BLM also engages in many activities to restore degraded ecosystems that contribute excessive sediment and salts to Colorado River Basin watersheds. These activities include constructing and maintaining grade-control structures, spreader dikes, and retention structures; emergency

stabilization and rehabilitation efforts following wildfires; removal of invasive plant species, channel stabilization and other riparian enhancements; maintaining road culverts; remediation of abandoned mine lands, and hire fuels reduction treatments. Salinity reductions for many of these activities continue to be difficult to quantify and report to the Forum because of factors such as the lack of adequate understanding about mobilization and transport of salts from rangelands and inability to conduct effectiveness monitoring for all projects. Reports from BLM State Offices (see below) reference many of these activities and the BLM is engaged in efforts with partner agencies to improve future ability to quantify salinity reductions from these efforts.

General Program

At the beginning of FY2014, a worldwide bibliographic handbook was completed by USDA ARS, USDA NAL, UNR and the BLM at a cost of $100,000. This handbook links land practices and resulting salinity loads. During the development of the handbook, research reviewed indicated that wind was the dominant method of transport of dissolved-solids across the landscape. BLM has already contracted with USDA ARS for wind transport work.

As a continuation, physical data is being collected in order to create a tool to detect sediment deposition and. Eventually the model simulations will lead us from BLM and BLM-collaboration funded plot or sub-catchment scale to watershed and, if needed, to regional scale. Our BLM projects that have been funded will be included in the model as validation for the combination of linked models. The sources and inputs of salinity data is now being received from more than just the Soil, Water and Air Program.

Overall Summary FY2014:

For FY 2014, $880,000 was allocated for BLM's salinity-control program. Funding predominantly went to science and on-the-ground-implementation projects. Later in the year, additional funds ($375,000) were directed to the Salinity Program for the development of a BLM-ARS tool. Therefore, the total that BLM contributed specifically toward the salinity-control program was $1.260 million dollars but BLM actually contributed more. In connection with BLM's initial project in finding a dominant dissolved-solid transport driver, wind is being given further attention and BLM is investing further in this process. In addition, there are several other programs that directly or indirectly that have been affecting salinity in the CRB: Soil, Water, and Air; Recreation-OHV; Rangeland; Acid Mine Land; Riparian; Wild Horse and Burro Management; Fire and Revegetation Emergency Stabilization Recovery; Renewable Energy (rights-of-ways); Fluid Mineral (orphaned wells); Hazardous Fuels Reduction (thinning forests, urban interface); and, Forests and Wetlands (grazed and unmanaged lands). The stated objective of past FAR's (2006-2012) was to increase emphasis on capturing salt loading through more on-the-ground projects, and BLM's efforts have contributed to this objective. . Since 2006, estimated cumulative tons of salt retained per year, respectively, within the CRB were reported in the FAR using the same equation.

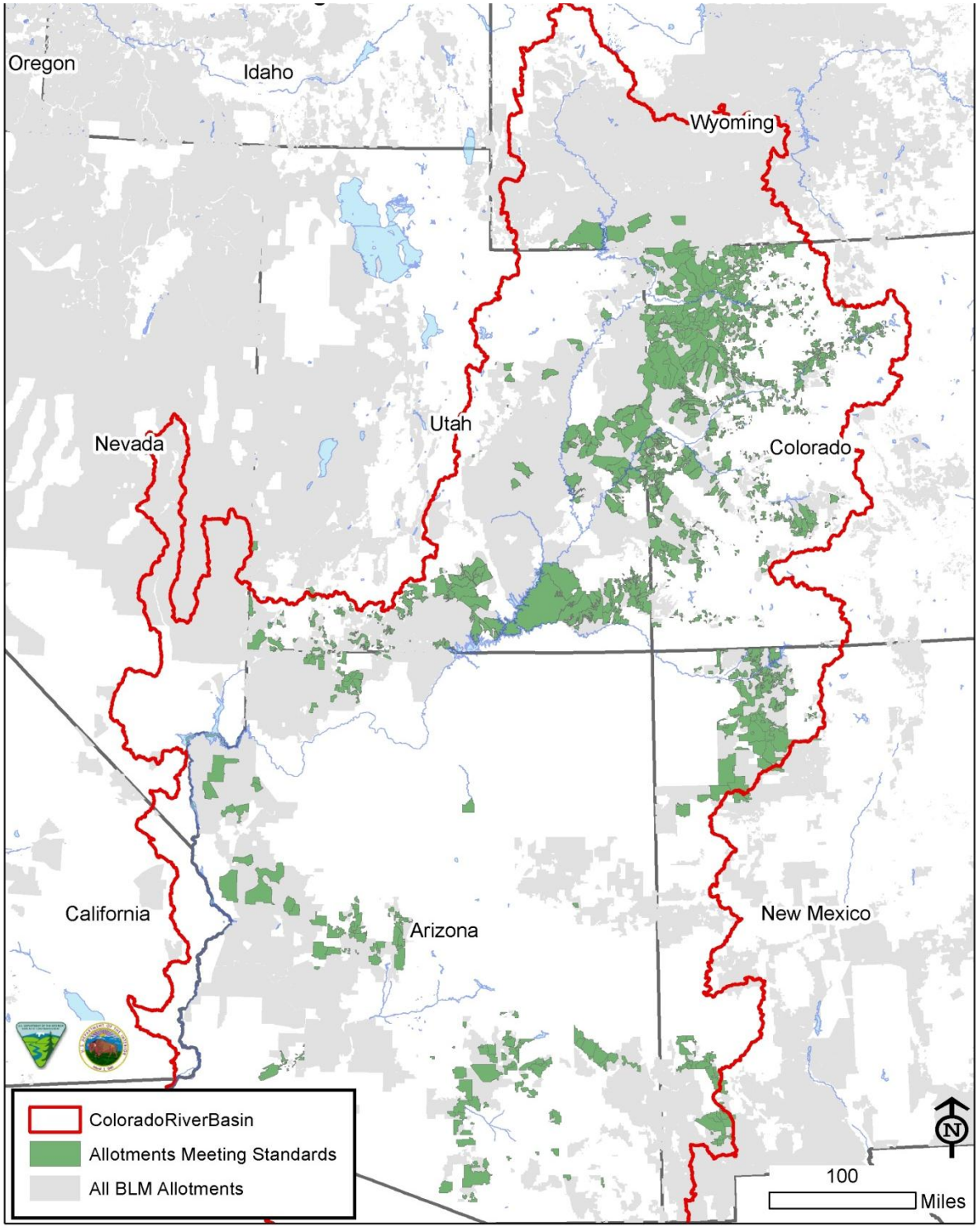
%salt = 3% by weight

Average bulk density of soils is 2.65 g cm^{-3}

Therefore, tons of salt retained per year: x miles * 2 cu yd $mile^{-1}$ * 4467 lb yd^{-3} * 0.03 lb salt lb $soil^{-1}$ = 13,401 lb salt = 6.7 tons of salt $year^{-1}$

In 2012 and 2009, 2,522 and 2,005 cumulative tons of salt retained per year were reported in the FAR, respectively. Upon further evaluation d after a reviewing several literature sources and GIS figures for the Colorado River Basin, the calculations will need to be refined.
Currently, within the Colorado River Basin 472 rangeland allotments totaling 2,990,441 acres, already meet or are making significant progress toward the land health standards (Fig. 1).

Figure 13 – Rangelands meeting all standards or making significant progress toward meeting the standards in the Colorado River Basin



Standards for Rangeland Health are ecologically-based goals that conform to the Fundamentals of Rangeland Health found in 43 Code of Federal Regulations Subpart 4180. Fundamentals of Rangeland Health are fundamental requirements for achieving functional healthy public lands. The Fundamentals, and the Standards for Rangeland Health that conform to the Fundamentals, address the necessary physical components of functional watersheds, ecological processes required for healthy biotic communities, water quality standards, and habitat for threatened and endangered species or other species of special interest.

Figure 14 – Clay Content (%) at 1:24,000 scale at 90m SSURGO for the true top soil layer. (The white areas should be a yellow color and are white only due to a computer processing limitation).

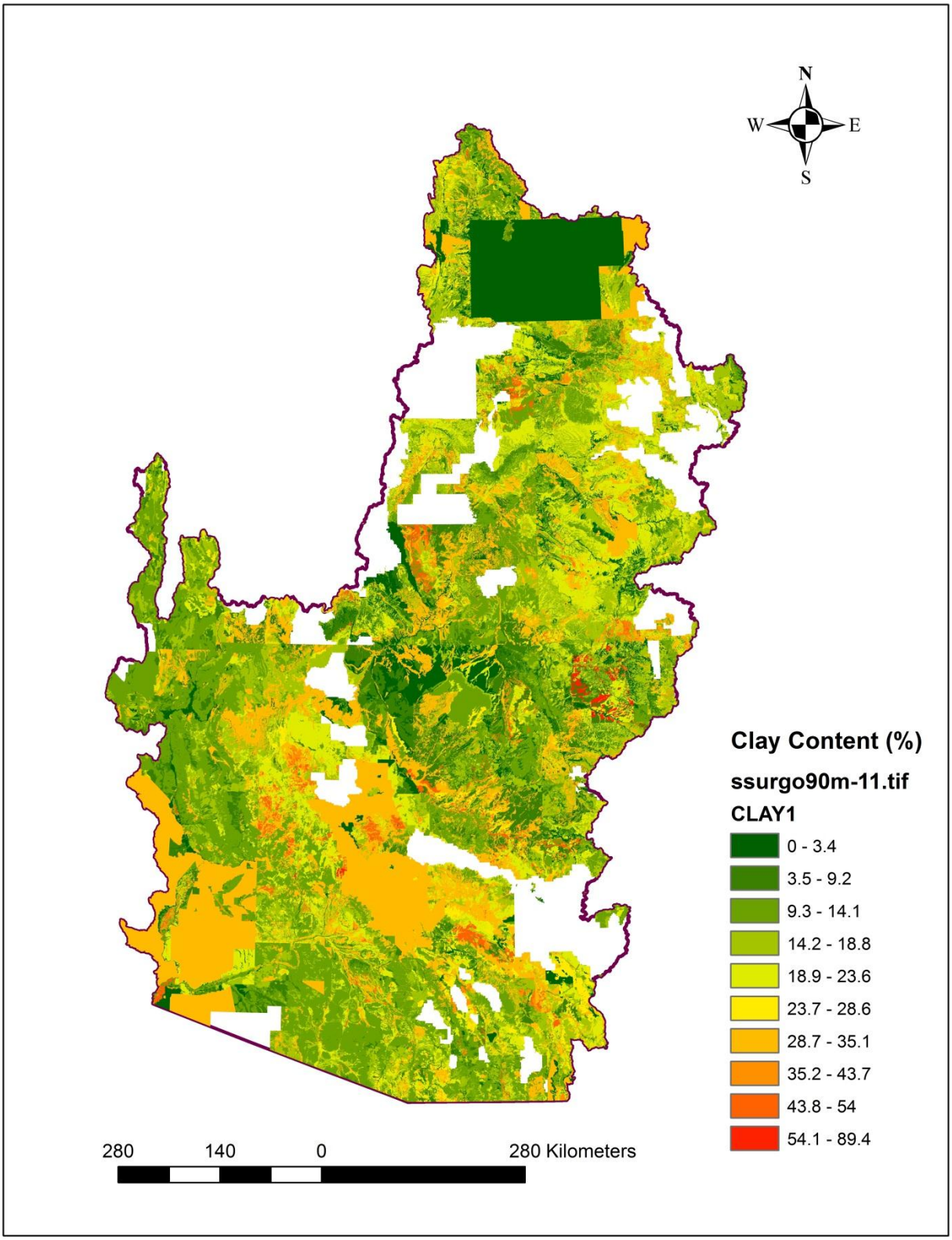
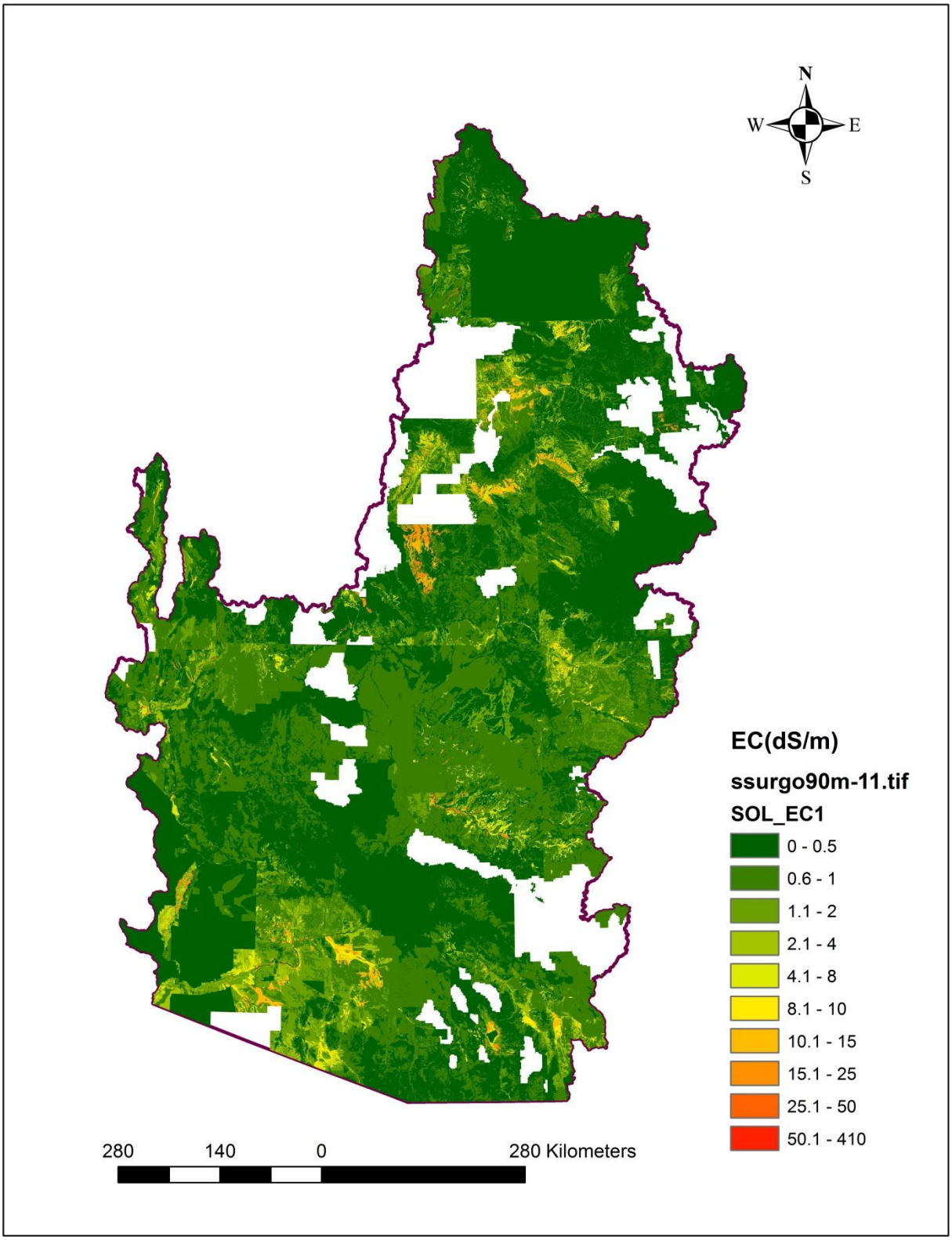


Figure 15 – Electrical Conductivity (dS/m) at 1:24,000 scale at 90m SSURGO for the true top soil layer. (The white areas should be a green color and are white only due to a computer processing limitation).



In the future, one can employ an equation to identify the quantity of salinity eroded or deposited due to various funded BLM proposals by overlaying the funded proposal area with the correct bulk density (as found in the appropriate county's soil survey) and the EC (Fig. 3).

Overall, the CRB has a gypsiferous ($CaSO_4$) surface layer, has a bulk density range of 1.1-1.6 g $cm^{-3,}$ pH 7.2-7.5, and average EC < 2 mmhos/cm; the soil is considered saline to highly saline. Therefore, the previous equation that has been used by the BLM for a minimum of the previous nine years requires adjustment and additional changes need to be made to the laboratory procedures that produce the mass of salt per mass of soil. While several uncertainties inherently exist with any measurement, our goal is to report BLM's best measured data of erosion or deposition of salt/ total dissolved solids. Additional uncertainty remains with the contract life of a dyke, the time it takes for it to be filled and maintained. Other projects (i.e., gabions, fencing, headcuts) that need to be maintained and how often they need to be maintained also needs to be factored into the equation. In addition to using recent datasets (both chemical and physical for land and water), the Health Standards Index will be included and updated each year to provide a more thorough reporting of BLM activities effects on salinity control.

Due to the predominance of gypsum in CRB, the equation mentioned above also has to be adjusted to account for the dominant geologic surface layer (gypsum ($CaSO_4$) or halite (NaCl)) that is present to account for its chemical properties to calculate the most efficient % salt eroded or deposited. Once validated, standard operating procedures will be established for use at the Field Offices level so that as projects are funded, data will collected consistently so that Salinity Coordinator can collate the data and calculate the best amount of salt reduced or retained within the terrestrial or surface water zones. Determining this correction needed for the equation will greatly enhance the certainty in our output. Including activities of other programs within BLM will contribute to more adequately and efficiently answering our main objective: quantitatively or qualitatively, how much has the BLM contributed toward salinity reduction/dissolved solids yields in the CRB?

STATE REPORTS

BLM State Offices submitted the following reports describing activities related to salinity control programs on BLM-administered lands. State reports include descriptions of projects conducted with designated Salinity Program funding through the SWA subactivity as well as summaries of activities conducted through other programs and permitted users that reduce the transport of sediment and salt to the Colorado River.

State: AZ	Project	FY14 funding	Notes
Wild Band Valley, Kanab Plateau	YELLOWSTONE #16 DIKE REPAIR	50000	Repair & reconstruct large dike in the erosion and flood control system; 2600 feet long and 8-10 feet high. 300 feet has to be rebuilt where the water pools. Supports the AZ Strategic Goal of Water for water quality. Project reports 312 tons of salt per year.
Lower CO River	MITTRY MSU SALINITY CONTROL	15000	Been creative since 2008 to get funds to conduct salinity control across 80 acres of lands and Mittry Lake; Monies support protection of grass fields from invasive species and improvement of soil conditions. Soils tested for salinity indicate a decrease in concentration.
San Simon Valley	SANDS DRAW SALINITY REDUCTION	5000	Riparian buffer established to provide bank stabilization, filter sediment, stabilize erosive areas using salt tolerant species and scattered trees to reduce soil salinity and surface runoff, etc.
	Total AZ	**70000**	
State: CO			
Badger Wash, ACEC	MANCOS SHALE EROSION	30000	Addresses impacts of grazing on the amount of sediment, saline, and Se released from upland soils using 4 paired watersheds (171,900 BLM acres)
Middle CO River Watershed	SALINITY ASSESSMENT	60000	has grant from state; $90k in kind; watershed project evaluates salinity, Se, sediment transport and other stream parameters from CO river from Glenwood Springs to DeBeque, CO
NW CO, Piceance Structural Basin	PICEANCE SALINITY DYNAMICS	70000	Collect data to adequately characterize salinity transport dynamics to evaluate impacts for oil and gas development via waste stream water mixed with surface waters and its impact on salinity dynamics
N.Fork of Gunnison and Rangely	MANCOS SHALE OIL/GAS MONT.	35000	Evaluate Se, salinity and sediment transport rate on Mancos shale prior to O&G development near Hotchkiss; paired watershed design
	Total CO	**195000**	

State NM			
San Juan Basin	SAN JUAN RVR BASIN RESTORATION	100000	Focus is on noxious weed removal that threatens native riparian habitat, cutting trees, and showing lack of understory plant growth leading to loss of top soils due to rain/snowmelt events that lead to surface products in the stream. Sediment fences are being built, Youth Conservation Corps are involved to restore native vegetation and soil erosion and salinity will be reduced.
San Juan River Basin	LA MANGA CANYON WATERSHED IMPROVEMENT	35000	Degraded rangelands including sagebrush grasslands and Pinyon/juniper woodlands on steep hill sides; minimal understory, excessive soil erosion; they would build sediment retention dams estimated salt savings 13.5 tons of salt per year with life expectancy of 10-12 years before maintenance needed
	WO gave additional $ to NM	100000	to support additional brush clearing in conjunction with fire relief and revegetation to retain sediment
	Total NM	**235000**	
State: UT			
Grand Staircase-Escalante National Monument	NLCS GSENM SALINITY CONTROL	100000	Several erosion control structures that need to be fixed due to deteriation that slow down erosional runoff, salinity and soil loss with the end point being the CO River
Uinta Basin	ARID LAND STUDY	10000	Located where recent energy development land disturbance with soils high in salinity and sodium. Try to reclaim using several BMPS including mulching, soil amendments, and examples used by the Green River District Reclamation Guidelines.
Onion Creek	ONION CREEK	40000	Due to collapsed salt domes with in the Paradox Formation that are directly in contact with Onion Creek, a tributary to the Colorado River, the road is constantly being eroded and repaired. This money was used for a feasibility study to assess alternative routes to access Fisher Mesa. Partnering with UDEQ.
Pariette Wetlands	PARIETTE ACEC IAP DATA	10000	Waterfowl habitat survey data analysis, for salinity, water quality and air quality

Pariette Wetlands	ONGOING GRAZING EXCLOSURES	40000	Multiagency collaboration to work with area of critical concern to protect ecosystem services, i.e. soil and water for structured decision-making. Local Youth corps constructs new grazing exclosures to better assess impacts on vegetation and sensitive soils from grazing. Soils undergo a variety of tests, i.e. infiltration, soil crust cover, baseline, to establish a baseline for the area.
Pariette Wetlands	ONGOING ACEC FENCING	25000	
Pariette Wetlands	PARIETTE WETLANDS	50000	Pariette Wetlands chemical and bottom sediment (1-10 cm) sampling w/ USU
		275000	
State: WY			
South Central	SALINITY AND SEDIMENT IN CRB	60000	Collects salt and sediment information on drainages within the Rawlins area that is part of the Greater CRB
WY	MUDDY CREEK TRIBUTARY EROSION	50000	Install gabions; has assistance in place; next year money is a precaution and may not need; lots of erosion has been occurring since no action was taken over the past year due to lack of funding
	Total WY	**110000**	
	Total States:	***$880000***	
			As SWA found additional funds throughout the FY14 WO & NOC worked to support funding toward a future Tool; funds were just received by ARS September 16, 2014
WO&NOC	BLM funds for tool project	375000	Photogrammetry v. Lidar Project hopefully for 4 sites or more, 5 year contract, led by ARS with hiring of 2 workers and involves ARS Tucson. Additional modelling work.
	Total FY14 BLM	**$1,260,000**	

ARIZONA-Aaron Wilkerson

Mittry MSU Salinity Reduction

2. Year(s) of Project 2008- present

3. Total money received to accomplish project FY14: $15,000.00

4. Total tons of salt retained (or loss) by action(s) completed and how calculated, acreage if applicable, road (miles), etc., vegetation planted. Soil salinity samples are taken annually. In 2008, when the project began, soil salinity levels averaged 137-162 Ms/cm. Due to these treatments, current salinity levels average 26-40 Ms/cm.

5. % salt unknown

6. This lower Colorado River project area which was originally nonnative saltcedar which was cleared to create native riparian habitat. This project reduces soil salinity through leaching, chemical application, and promoting grass growth through fertilizer treatments as a means to condition the soils so they are suitable for native riparian trees. During FY14, the first 10 acres of the 43 acre moist soil units was planted in native cottonwood and willow in February where the survival rate is greater than 90% success.

7. We are currently implementing this 43 acre project, but are in the planning stages to expand the project area an additional 265 acres on adjacent lands.

Yellowstone #16 Dike Repair

2. Year(s) of Project – 2014 and Project has been accomplished.

3. Total money received to accomplish project - $50,000

4. Total tons of salt retained (or loss) by action(s) completed and how calculated, acreage if applicable, road (miles), etc., vegetation planted - 312 tons of salt retained per year

5. If known %salt in soil - 2 to 12 % salt in alluvium and 30 % salt in residuum surfaces.

6. This project would retain 312 tons of salt per year by trapping saline sediment from eroding alluvial fan soils that have from 2 to 12 % gypsum and other salts in their profiles. Additional saline water and sediment is coming off of gypsiferous badland residual soils (30 to 65 % surface gypsum content), of the Moenkopi formation, that are the uplands of the watershed. Severe dendritic gully head cutting is preceding upslope from the breach. That would be stopped after the repairs are completed, as the saline sediment would then be trapped, filling the gullies and raising the base levels. It would also detain much of the saline runoff water, allowing for aquifer recharge, salt precipitation, sedimentation, and the secondary benefit of the establishment of some riparian wildlife habitat.

7. Implementation

Sands Draw Salinity Reduction

2. Year(s) of Project: 2009 – Present

3. Total money received to accomplish project: $5,000, plus partner contributions (Table 1).

Table 4 – Partner Contributions for Sands Draw Salinity Reduction Project.

Partner	Contribution	Total Contribution Value
Gila Watershed Partnership	6,000 pounds weed free straw	$6,000.00
Southwest Conservation Corps	Labor for two-weeks	$3,200.00
Gila Watershed Partnership	443 Plants	$886.00

4. Total tons of salt retained (or loss) by action(s) completed and how calculated, acreage if applicable, road (miles), etc., vegetation planted: Approximately one acre of highly erodible and saline soil was stabilized by mulching, seeding and planting of native grasses, and planting of straw mulch. The Sands Draw salinity reduction project complements and supports previous restoration and enhancement work within Sands Draw Wildlife Exclosure that focused on restoration of surface hydrology through construction of rock dams, berms, straw wattles, mulching, and seeding and planting of native grasses and flowers.

5. unknown

6. Three sentences to describe project: A two-tiered riparian buffer will be created through seeding and plantings of salt tolerant species to: 1) protect the aquatic habitat at Sands Draw from nonpoint source pollution (Figure 1), 2) provide bank stabilization, 3) facilitate sediment filtering, and 4) stabilize active erosion areas. The first tier of the buffer will be comprised of salt grass, giant and alkali sacatons, forbs, and trees; whereas the second tier will consist primarily of native sacaton grasses, which are salt tolerant and scattered trees. Both tiers will reduce soil salinity and surface runoff, increase infiltration, prevent further degradation, and provide much needed habitat for residential and migratory wildlife. The addition of vegetative material and subsequent addition of detrital organic matter will reduce effective soil salinity.

7. Is your project under what type of category: a. administrative, planning, implementation?: Implementation.

8. Project Status: On-going

9. Accomplishments to date for Fiscal Year 2014:

- November 22, 2013: Invited Speaker - Special Symposium: Restoration of degraded aquatic habitats: A watershed approach at the 45th annual meeting of the Desert Fishes Council. Presented an oral presentation titled: Challenges, constraints, and realities in enhancing, creating, and restoring aquatic and terrestrial habitats for wildlife in the desert.
- July 16, 2014: Heidi Blasius, Fisheries Biologist, Jeff Conn, Natural Resource

Specialist, Alex Smallwood, BLM Intern, Clara Hoyle, BLM Intern, Morgan Cheyney, BLM Intern, and Arizona Conservation Corps Crew planted 104 alkali sacaton and 108 plains lovegrass (Figure 2).

- July 17, 2014: Heidi Blasius, Fisheries Biologist, Jeff Conn, Natural Resource Specialist, Alex Smallwood, BLM Intern, Clara Hoyle, BLM Intern, Morgan Cheyney, BLM Intern, and Arizona Conservation Corps Crew planted 91 alkali sacaton and 240 plains lovegrass.
- Approximately one acre was seeded (80 pounds of seed mix), fertilized (63 cubic feet), and straw mulched, including vertical mulching. Additional fieldwork is scheduled for September 2014.

Figure 16 – Native grass buffer along wetted habitat at Sands Draw Wildlife Exclosure.

Figure 17 – Arizona Conservation Corps Crew and BLM interns and personnel planting native grasses at Sands Draw Wildlife Exclosure as part of the salinity reduction project.

Colorado-Ed Rumbold

Uncompahgre Field Office

1. *Project Title*: **Mancos Shale Paired Watershed Study**

2. *Year(s) of Project*: 2013 - Funding applied to field office expenses and 2014 - Funding received and in the planning stages

3. *Total money received to accomplish project*: $35,000

4. *Total tons of salt retained* (or loss) by action(s) completed and how calculated, acreage if applicable, road (miles), etc., vegetation planted

Unknown at this time. We are working with the USGS right now to select sites.

5. %salt in soil: Unknown.

6. Project Description: This project will evaluate salinity, sediment and selenium transport rates on Mancos shale using sediment cores. Sites disturbed by oil and gas development as well as sites undisturbed will be selected with similar slope, aspect, and precipitation conditions. Disturbances like grazing will be considered to isolate impacts.

7. *Project Category*, i.e. administrative, planning, implementation, ?: currently in the planning phase.

Silt Field Office

1. *Project Title*: **Middle Colorado River Watershed Assessment and Plan**

2. *Year(s) of Project*: FY2014-2018

3. *Total money received to accomplish project*: $60,000

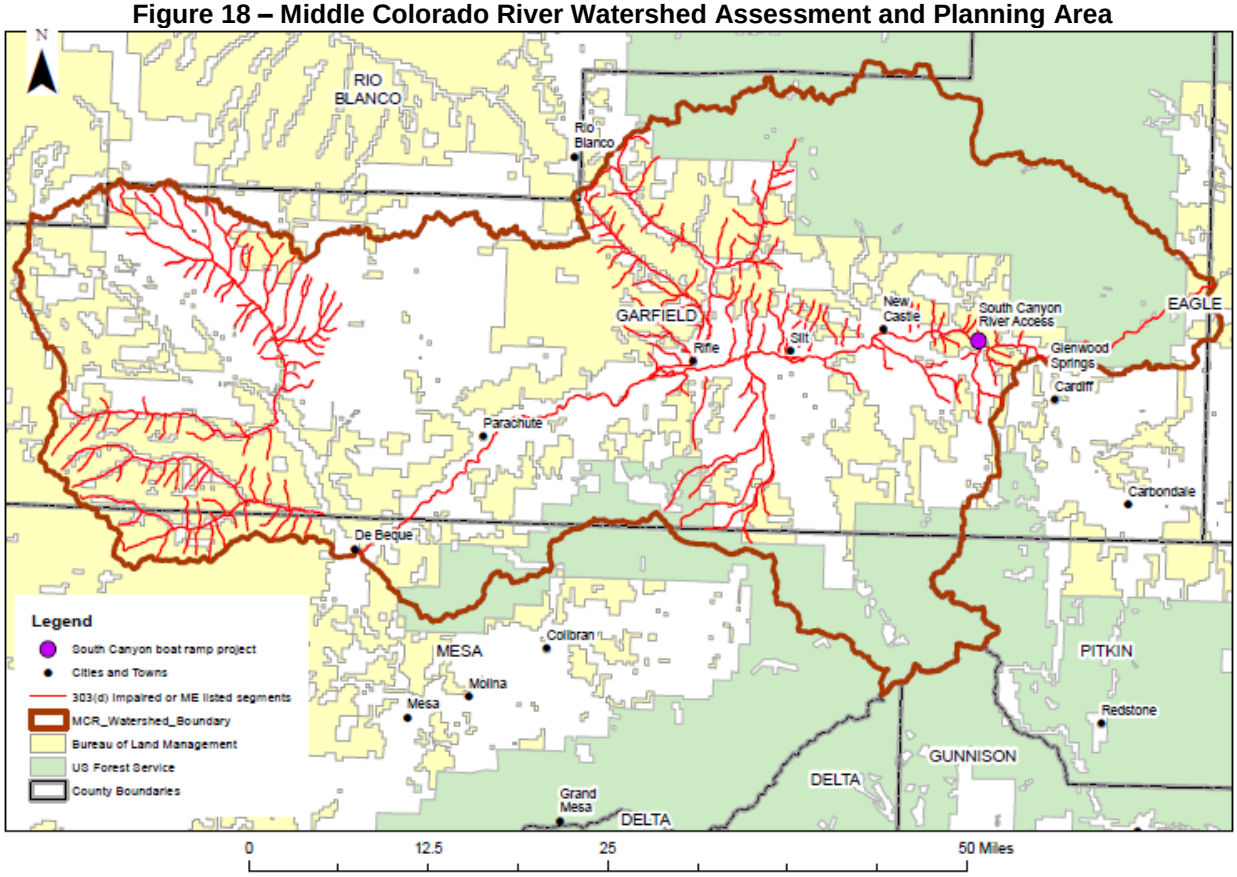
4. *Total tons of salt retained* (or loss) by action(s) completed and how calculated, acreage if applicable, road (miles), etc., vegetation planted: Unknown at this time.

5. If known %salt in soil: Unknown at this time.

6. *Describe project*: This project will evaluate water quality impairments related to selenium, salinity, sediment transport and other watershed parameters throughout the Middle Colorado River Watershed (MCRW), which includes tributaries to the Colorado River from Glenwood Springs to DeBeque, CO (portions of three BLM Field Offices - CRVFO, GJFO, and WRFO) across 400,000 acres of public land. Funding will help support the non-profit Middle Colorado River Watershed Council to assess water quality exceedances/303(d) impairments, inventory sources of transport such as water developments/diversions, and identify opportunities for watershed improvements through a formal watershed plan. This partnership will continue efforts to address tamarisk/weeds infestation and restore riparian areas, native vegetation and saline/fragile soils. The watershed planning effort will be a comprehensive and cooperative partnership to address water quality/quantity, energy development, mining, agriculture, and other land uses along the Colorado River.

7. Primarily in planning phase, with one construction project being implemented this Fall. The South Canyon boat ramp is currently native surface that typically erodes during spring runoff. The project will construct a concrete ramp that will reduce sediment/salinity inputs to the Colorado River and be safer for the public.

Figure 18 – Middle Colorado River Watershed Assessment and Planning Area



White River Field Office

1. *Project Title:* **Piceance Salinity Dynamics** – Bob Lange

2. *Year(s) of Project*: 5

3. *Total money received to accomplish project*: $70,000

4. *Total tons of salt retained* (or loss) by action(s) completed and how calculated, acreage if applicable, road (miles), etc., vegetation planted – N/A

5. *If known %salt in soil:* Unknown.

6. *Project Description and background*:

The Colorado River Salinity funding (CRS Funds) for the White River have been used to augment existing United States Geological Survey (USGS) Streamflow monitoring sites, support USGS reports based on data collected, purchase equipment for Bureau of Land Management (BLM) monitoring, and hire seasonal personal for field work. This amount of work would not have been possible with CRS Funds alone, but with additional monies from a BLM Washington Office funding for resources monitoring related to energy exploration and development. These two funding sources resulted in a significant amount of baseline data collected and analyzed in

the White River, Piceance Creek and Yellow Creek watersheds. The reports and data generated can be used to define the impact of groundwater on salinity in surface waters specifically the salinity loads from the White River.

WRFO's proposed Resource Management Plan Amendment and Final Environmental Impact Statement (PRMPA/FEIS) impact analysis identified the potential for an increased runoff and soil erosion from surface disturbance associated with oil and gas development. Eroded soil carried via surface runoff may increase salinity loads in surface waters. The impact analysis also identified that freshwater use by oil and gas development within valid water rights may decrease surface flows in streams and increase the proportion of baseflow from groundwater and thereby increase salinity concentrations in surface waters.

Overall accomplishments:

- Maintain conductivity probes on Piceance Creek (5 years of record) and Yellow Creek (2 years of record).

Figure 19 – USGS Yellow Creek Streamflow Site

- Collection of additional water quality sampling in the White River, Piceance Creek and Yellow Creek. Water quality sampling measured the following parameters:
-
    - Physical: pH, temperature, specific conductance, dissolved oxygen (DO), DO saturation, turbidity, salinity, and hardness
    - Nutrients: Inorganic nitrogen (nitrate plus nitrite), total phosphorus, orthophosphate, ammonia, and Kjeldahl nitrogen
    - Metals: Aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc
    - Other: alkalinity, bicarbonate, boron, calcium, carbonate, chemical oxygen demand, chloride, hydroxide, magnesium, sodium, potassium, sulfate, total organic carbon, total dissolved solids [TDS], total suspended solids [TSS], BTEX (e.g., benzene, toluene, ethylbenzene, xylenes).

- Seven streamflow measurement sites maintained by the BLM to measure stream discharge, conductivity, air and water temperature and conduct water quality

sampling.

Figure 20 – Chris Moreno at Black Sulphur BLM Streamflow Site

- Over 500 groundwater springs were inventoried over four seasons including the collection of field water quality parameters. Information from this inventory can be used to identify springs with high salinity and monitor future development of energy resources.

Figure 21 – Spring Inventoried in FY2014 by Jesse McGill and Chris Moreno

- The groundwater sampling program with USGS sampled the five wells. This sampling effort uses multiple approaches to isotopic analysis to look at ages and source of water (McMahon, in review). This information can be critical to defining the naholite input of salts to the White River.

Grand Junction Field Office

Project Title**: Coal Mine Impact Study Phase 2**

Year(s) of Project/Description: The project was started in 2011 and has been ongoing since.

Total FY14 Funding: $25,000

Project description: Underground coal mining has the potential to impact surface and groundwater processes; such as land subsidence on groundwater flow systems, mine dewatering on spring/stream flow, water quality, mine related disturbance on peak stream discharge and

fluvial sediment loads, and effects of mining on salt loads to the Colorado River. Funding will support one full time seasonal employee who will continue monitoring at established sites (surface water, springs/seeps, deep groundwater monitoring wells, and shallow groundwater monitoring wells). Data will be collected prior to, during, and after coal mining in the Big Salt Wash, East Salt Creek and West Salt Creek watersheds.

Salt Retention: Information gained from continuation of this project will help BLM and others better understand natural hydrologic conditions prior to coal mine expansion. Likewise, information gained from the project would help BLM and others better address areas of sensitivity to minimize adverse impacts to water quality resulting from future mining operations.

%salt in soil: salt content per unit weight is variable by soil mapping unit within the study area.

Project Category: Planning/Research

Figure 22 – Stream Monitoring in East Salt Creek near McClane Canyon Coal Mine:

Figure 23 – Stream Monitoring in Big Salt Wash (within the Bookcliff Coal Lease Area)

Project Title: **Mancos Shale Erosion** - Grand Junction Field Office

Year(s) of Project/Description: Originally started in 1953. The project was re-initiated in 2006 and has been ongoing ever since.

Total FY14 Funding: $30,000.00

Project description: USGS in coordination with BLM installed a network of flumes, silt fences, precipitation gages, and dust collectors above reservoirs in sub-watersheds. As a result, USGS has successfully measured hillslope-scale erosion rates in the paired watersheds using these devices. Hillslope-scale erosion rates from the paired watersheds will be utilized to customize key parameters in the Rangeland Hydrology Erosion Model (RHEM) for more accurate quantification of erosion and salt contributions to the Colorado River from public lands in Western Colorado.

Salt Retention: Information gained from continuation of this project will help BLM and other land managers better quantify actual erosion rates and salt delivery to the Colorado River from the Mancos shale landscape. Currently, BLM GJFO is utilizing RHEM results to help develop disturbance thresholds in Mancos shale landscapes as part of the bureau's comprehensive travel management planning effort.
%salt in soil (estimate): unknown

Project Category: Planning/Research

Figure *24 – Silt fences constructed in Badger Wash (hill-slope erosion monitoring):*

Figure 25 – Badger Wash Climate Station and Flume:

Dust

Figure 26 – Wind Erosion Monitoring in Badger Wash:

Ed Rumbold, Pauline Adams, Bob Lange, Jedd Sondegard, and Nate Dieterich - hydrologists

New Mexico-Barney Wegener

Funds ($100,000) are currently obligated to the Assistance Agreement with San Juan Soil and Water Conservation District. The agreement has been a successful partnership between the SWCD and BLM to accomplish inventory, treatment and monitoring of noxious weed treatments throughout the San Juan River watershed. These funds will go to continue targeted noxious weeds, including thistle, knapweed, cheatgrass and halogeten as well as woody invasive in riparian areas such as Russian olive and tamarisk. We anticipate the funds to be used over a period of months in fall of 2014 and spring of 2015 as certain project components are dependent on time of year. Based on previous years' work, this money will accomplish 150,000 acres of inventory, 60,000 acres of monitoring and 750 acres of treatment.

The remainder of funds ($95,000) and ($35,000) have been deposited into the Assistance Agreement with New Mexico Association of Conservation Districts. These funds will go toward sagebrush treatments (7000 acres) and pinyon-juniper (P-J) thinning and seeding (20 acres). In areas where P-J is encroaching, a native seed mix will be spread, p-j will be cut into 2 foot pieces and spread throughout the area to provide cover for seed as well as aid in reducing erosion and run off into the San Juan River. Sagebrush areas that have poor herbaceous understory are targeted for aerial herbicide application (Tebuthiuron). With a more complex root system than sagebrush, an increase in the grass component will aid in soil stabilization, resulting in a reduced soil movement and a decrease in sediment entering the San Juan River.

Utah-Jeremy Jarnecke

65605 UT 5 DARREN WILLIAIMS PARIETTE ACEC IAP DATA 10000

This salinity funding was provided to Utah State University (USU) to assist the BLM Vernal Field Office in the development of an Environmental Assessment (EA) which will produce an Integrated Activity Plan (IAP) for the management of the Pariette Wetlands Area of Critical Environmental Concern (ACEC).

Development of an Integrated Activity Plan is a requirement of the 2008 Vernal Resource Management Plan (RMP). The IAP identifies goals for the ACEC, management actions to achieve those goals, and monitoring requirements to ensure the identified goals are achieved. The management actions include RMP requirements, general management practices, allowable uses and constraints, and mitigation measures that would protect and enhance the Pariette Wetlands ACEC relevant and important values, special status bird and plant habitat and wetlands ecosystem while recognizing valid existing rights.

The assimilation of the raw data that USU is analyzing is a crucial first step in this process. Attached is an interim report outlining the work USU has performed utilizing these funds. In addition, a doctoral USU student and their lab is processing the top 10 cm of sediment within the major ponds to identify reduction-oxidation status and the chemicals and types of sediment present in collaboration with Dr. Green Rossi (BLM).

2014 EOY Eight Mile Salinity Report

Grand Staircase-Escalante National Monument

In 2014 the Grand Staircase-Escalante National Monument received a BPS award for $100,000 to continue repair and maintenance work on the Eight Mile Salinity Control structure. This phase was to restore the majority of impounding capacity of the reservoir.

Work began June 3 after all contracted equipment had arrived at the project site. Measurements at the dam were taken and a buffer was established to ensure no water or runoff material contacted the original dam structure. This was to maintain the integrity of the original dam which has functioned properly for 47 years. This portion of the reservoir had only three feet of free-board due to the saline soil build up in the impoundment area from 40 years of run-off. Figure 1 shows main reservoir before excavation work.

Figure 27 – 2014 Phase 2 Main reservoir area before excavation work began.

The main reservoir area is approximately 200 yards long by 150 feet wide. A 3:1 taper along the banks was planned for which allows for wildlife and livestock to access any impounded water.

Salinity Funded Project Update for Utah BLM – Moab Field Office

Due to a late start with the final FY14 budget, we were not able to schedule construction of any grazing exclosures this year. We have ordered the supplies and contracted with the Canyon Country Youth Corps to do this work either this fall or next spring as their schedule allows. We did work with the USGS Mike Duniway to conduct detailed vegetation and soil studies in and adjacent to 6 existing grazing exclosures. The USGS will submit an informal report at the end of Dec summarizing these studies done over the last couple of years.

The Ten Mile Wash ACEC fencing project is ongoing in the Moab Field Office. This involves field work to assess trespass conditions, existing fencing conditions and additional fencing needs. Several fences were added, several fences were repaired and many site visits were made to understand if the fencing projects were adequate or working. Although this sounds simple, the Ten Mile Wash ACEC is remote and most of the fencing locations are only accessed by a long hike.

Onion Creek: The Moab Field Office is working with the Grand County Road Dept to contract a feasibility study on stabilizing the Onion Creek Road. This study will be conducted by Horacks Engineering and should be completed by Dec 31, 2014. This study will evaluate different road locations and stabilization techniques that would decrease the impacts from large floods on the

road, the Onion Creek corridor and associated water quality conditions.

Vernal Field Office

Arid Lands Study

In 2014, VFO received $10,000 to continue studying vegetative reclamation of disturbed arid lands (typically well pads and associated energy infrastructure) in the Uinta Basin of northeast Utah. Previous phases I & II have concluded that 1) most disturbed sites are compacted and soils have high salinity content, 2) Invasive or noxious species (halogeton, cheatgrass, russian thistle) are prevalent, and 3) amending soils with organic carbon increases establishment of native plants and negatively effects invasive/noxious species. With 2014 salinity funding, a series of 6x6 meter plots with nine different treatments were established at two locations. Monitoring of native plant establishment, invasive/noxious species, compaction control, and organic carbon content are to be monitored for at least two-three years after plot establishment.

Figure 28 – Photo of treatment plots.

Pariette Wetlands

In 2014, VFO received $50,000 for operations and ongoing studies associated with the Pariette Wetland system in the Uinta Basin of northeastern Utah. This salinity funding was provided to Utah State University (USU) to assist the BLM Vernal Field Office in the development of an Environmental Assessment (EA) which will produce an Integrated Activity Plan (IAP) for the management of the Pariette Wetlands Area of Critical Environmental Concern (ACEC).

Development of an Integrated Activity Plan is a requirement of the 2008 Vernal Resource Management Plan (RMP). The IAP identifies goals for the ACEC, management actions to achieve those goals, and monitoring requirements to ensure the identified goals are achieved. The management actions include RMP requirements, general management practices, allowable uses and constraints, and mitigation measures that would protect and enhance the Pariette Wetlands ACEC relevant and important values, special status bird and plant habitat and wetlands ecosystem while recognizing valid existing rights.

Utah State University is in process of analyzing existing data to develop waterfowl trends for

abundance, occupancy, and species richness. The report is expected to be completed and delivered in 2015.

Grand Staircase-Escalante National Monument

In 2014, GSENM received $100,000 in Salinity Funding to continue restoration of impoundment capacity of Eight Mile Reservoir. The reservoir was installed ~50 years ago below an expansive outcrop of high-saline soils. Since installation, the reservoir has accumulated ~16 feet of sediment over ~7 acres. Approximately 13-15,000 cubic yards of sediment were excavated and deposited in a stable upland location.

Figure 29 – Eight Mile Impoundment before excavation.

Figure 30 – Eight Mile Impoundment after excavation.

Wyoming-Marty Griffith

Previous funds ($100,000) are currently obligated to the Assistance Agreement with San Juan Soil and Water Conservation District. The agreement has been a successful partnership between the SWCD and BLM to accomplish inventory, treatment and monitoring of noxious weed treatments throughout the San Juan River watershed. These funds will go to continue targeted noxious weeds, including thistle, knapweed, cheatgrass and halogeten as well as woody invasive in riparian areas such as Russian olive and tamarisk. We anticipate the funds to be used over a period of months in fall of 2014 and spring of 2015 as certain project components are dependent on time of year. Based on previous years' work, this money will accomplish 150,000 acres of inventory, 60,000 acres of monitoring and 750 acres of treatment.

The remainder of FY14 funds ($95,000) and ($35,000) have been deposited into the Assistance Agreement with New Mexico Association of Conservation Districts. These funds will go toward sagebrush treatments (7000 acres) and pinyon-juniper (p-j) thinning and seeding (20 acres). In areas where P-J is encroaching, a native seed mix will be spread; p-j will be cut into 2 foot pieces and spread throughout the area to provide cover for seed as well as aid in reducing erosion and surface runoff into the San Juan River. Sagebrush areas that have poor herbaceous understory are targeted for aerial herbicide application (Tebuthiuron). With a more complex root system than sagebrush, an increase in the grass component will aid in soil stabilization, resulting in a reduced soil movement and a decrease in sediment entering the San Juan River.

Bureau of Reclamation
Colorado River Basin Salinity Control Program
Accomplishments for Fiscal Year 2014

Salinity Modeling Studies

TDS Forecast Modeling

In FY 2014 Reclamation continued to conduct water quality modeling to project TDS concentrations below Hoover Dam forward two years. To project TDS concentrations below Hoover Dam, Reclamation modeled TDS in the two reservoirs, Lakes Powell and Mead, using CE-QUAL-W2 models. Reclamation's "24-Month Study" provided monthly reservoir inflows, outflows, and pool elevations for the modeling. The results of the January 2014 simulation projected TDS concentrations below Hoover Dam would remain at the 2014 levels of 600 mg/L through the end of 2015.

Colorado River Simulation System (CRSS)

In FY 2014 Reclamation completed modeling studies for the 2014 Triennial Review. Results from five model scenarios were requested at the Salinity Control Forum Workgroup in February, 2014. The five scenarios presented included:

1. No additional controls, but including projected controls from NRCS through 2014 (1.33M tons control)
2. Plan of Implementation through 2017, no additional controls after 2017 (1.39M tons control)
3. Plan of Implementation through 2017, 1.85M tons control by 2035
4. Plan of Implementation through 2017, 1.63M tons control by 2035
5. Plan of Implementation through 2017, 1.68M tons control by 2035

Results for the probability of exceedance of the numerical criteria were provided for the 2014 Triennial Review document for each model scenario. Economic damage estimates also were quantified at the three numeric criteria locations in the Lower Colorado River basin based on modeling study results for each scenario.

The salinity removed by water quality improvement projects was updated in November 2013 to account for modifications and extension of salinity control levels provided by Reclamation, NRCS, and BLM. Historical salinity control levels are presently available from 1980-2012. The CRSS salinity model and natural salt database was updated to incorporate these data.

Economic Impacts Model

The Salinity Damages Model estimates the quantitative damages that are incurred in the metropolitan and agricultural areas in the lower Colorado Basin that receive Colorado River

water. The model estimates the impacts from salinity levels greater than 500 mg/L TDS on household water using appliances, damages in the commercial sector, industrial sector, water utilities, and agricultural crop revenues. It also estimates the additional costs related to meeting state wide water quality standards for ground water and recycled water use in the Metropolitan Water District (MWD) service area.

In FY14 the Salinity Damages Model was updated with actual 2010 data and projections on 5-year intervals to 2040. Updated inputs included water use in AF, water demand in AF, and demographic data for 15 MWD subareas, and demographics data for Arizona and Clark County, Nevada. Agricultural price and acreage data for Imperial and eastern Riverside Counties was collected, aggregated into representative crops and incorporated into the Salinity Damage Model. Once the updates had been incorporated into the Salinity Damage Model, economic damages were estimated for several alternatives, including two scenarios evaluating economic damages if no salinity control program had ever been implemented and three scenarios comparing varying levels of salt control in future years. In all cases, the Salinity Damage Model evaluates economic damages under "with" and "without" project conditions, which allows annual damages to be estimated and annual benefits accruing from the implementation of the Salinity Control Program to be evaluated. Economic benefits of the Salinity Control Program are computed as the difference in damages under the "with" and "without" project conditions.

Estimated 2010 Damages without Salinity Control Program

The Salinity Damages Model was used to estimate historic damages for 2010 assuming the salinity control program had never existed prior to 2010. The 2010 TDS values for the no salinity control program scenario were estimated by the Salt Model in November, 2013. The Salt Model-estimated TDS values were compared to the observed 2010 TDS values at Hoover, Parker, and Imperial Dams, which are dependent on the Plan of Implementation. Table 5 presents the 2010 observed TDS values, the Salt Model-estimated TDS values, the economic damages under each alternative, and the economic benefits estimated from having the Plan of Implementation.

Table 5 – Historic TDS Values and Economic Damages at Hoover, Parker, and Imperial Dams When Comparing 2010 Actual TDS Values to Estimated TDS Values Under a No Salinity Control Program Assumption.

	Hoover	Parker	Imperial	
With Plan of Implementation TDS (observed)	575	595	690	
No Salinity Control Program TDS	656	678	788	
				Total
With Plan of Implementation Annual Damages	$15,484,000	$129,228,000	$220,864,000	$365,576,000
No Salinity Control Program Annual Damages	$32,233,000	$247,537,000	$337,910,000	$617,680,000
Annual Benefits (Difference in Damages)				$252,104,000

Estimated 2030 Damages without Salinity Control Program

In Table 6, the analysis of comparing economic damages under a no salinity control program assumption to the existing plan of implementation was projected out to the year 2030. TDS levels for both the "with plan of implementation" assumption and the "no salinity control program" assumption were estimated along with the annual economic damages and the estimated economic benefit. The 2030 TDS values were estimated in November, 2013 and used in the updated model in August, 2014.

Table 6 – TDS Values and Economic Damages at Hoover, Parker, and Imperial Dams When Comparing 2030 TDS Values Under a With Plan of Implementation Assumption to Estimated TDS Values Under a No Salinity Control Program Assumption.

	Hoover	Parker	Imperial	
With Plan of Implementation TDS	609	632	744	
No Salinity Control Program TDS	651	675	792	
				Total
With Plan of Implementation Annual Damages	$29,114,000	$180,893,000	$287,439,000	$497,446,000
No Salinity Control Program Annual Damages	$40,340,000	$243,164,000	$345,407,000	$628,911,000
Annual Benefits (Difference in Damages)				$131,465,000

Estimated 2014, 2017, 2035 Damages with No Additional Controls, 1.33 Millions of Salt

The second set of scenarios evaluated with the updated Salinity Damage Model included examining annual damages sustained when varying levels of salinity control have been implemented. The TDS values for these scenarios were estimated by the CRSS Model. The "without project" assumption for these scenarios assumes no additional salinity control projects will be implemented in the future. The "with project" condition assumes that the Plan of Implementation will be implemented and additional salinity will be controlled.

Through 2014 an estimated 1.33 million tons of salinity control had been implemented. The CRSS Model was used to project TDS values for 2014, 2017, and 2035 assuming that no additional salinity controls would be implemented.

Table 7 – Estimated TDS Values and Annual Damage Estimates for 2014, 2017, and 2035 at Hoover, Parker, and Imperial Dams Under a No Additional Control Scenario When 1.33 Million Tons of Salinity Control has been Implemented.

	TDS Values No Additional Controls			
Year	Hoover	Parker	Imperial	
2014	588	592	704	
2017	633	653	768	
2035	642	663	784	
	Annual Damages by Location			Total Damages
2014	$19,396,000	$125,374,000	$237,587,000	$382,357,000
2017	$30,352,000	$202,581,000	$314,673,000	$547,606,000
2035	$40,088,000	$238,080,000	$336,354,000	$614,522,000

Estimated 2017, 2035 Damages with Plan of Implementation, 1.39 Million Tons of Salt

TDS values for a "with" project condition were estimated by the CRSS Model for 2017 and 2035 when 1.39 million tons of salt will be controlled by the Plan of Implementation. Annual damages for 2017 and 2035 were estimated by the Salinity Damage Model. Annual benefits were calculated by finding the difference in annual damages for similar years between the "without" project condition and the "with" project condition. Benefits from the Plan of Implementation come to $4.439 million ($547.606 million minus $543.167 million) for 2017 and $16.232 million for 2035 ($614.522 million minus $598.29 million).

Table 8 – Estimated TDS Values and Annual Damage Estimates for 2017 and 2035 at Hoover, Parker, and Imperial Dams Under a Plan of Implementation Scenario When 1.39 Million Tons of Salinity Control has been Implemented.

	TDS Values With Plan of Implementation, 1.39 MT				
Year	Hoover	Parker	Imperial		
2017	631	651	767		
2035	637	658	778		
	Annual Damages by Location			Total Damages	Annual Benefits
2017	$29,896,000	$199,823,000	$313,448,000	$543,167,000	$4,439,000
2035	$38,677,000	$230,513,000	$329,100,000	$598,290,000	$16,232,000

Estimated 2035 Damages with Plan of Implementation, 1.85 Million Tons of Salt

TDS values for a "with" project condition were estimated by the CRSS Model for 2035 when 1.85 million tons of salt will be controlled by the Plan of Implementation. Annual damages for 2035 were estimated by the Salinity Damage Model. Annual benefits were calculated by finding the difference in annual damages for similar years between the "without" project condition and the "with" project condition. Benefits from the Plan of Implementation come to $111.325 million ($614.522 million minus $503.197 million) for 2035.

Table 9 – Estimated TDS Values and Annual Damage Estimates for 2035 at Hoover, Parker, and Imperial Dams Under a Plan of Implementation Scenario When 1.85 Million Tons of Salinity Control has been Implemented.

	TDS with Plan of Implementation, 1.85 MT				
Year	Hoover	Parker	Imperial		
2035	608	628	744		
	Annual Damages by Location			Total Damages	Annual Benefits
2035	$30,482,000	$184,781,000	$287,934,000	$503,197,000	$111,325,000

Estimated 2035 Damages with Plan of Implementation, 1.63 Million Tons of Salt

TDS values for a "with" project condition were estimated by the CRSS Model for 2035 when 1.63 million tons of salt will be controlled by the Plan of Implementation. Annual damages for 2035 were estimated by the Salinity Damage Model. Annual benefits were calculated by finding the difference in annual damages for similar years between the "without" project condition and the "with" project condition. Benefits from the Plan of Implementation come to $69.466 million ($614.522 million minus $545.056 million) for 2035.

Table 10 – Estimated TDS Values and Annual Damage Estimates for 2035 at Hoover, Parker, and Imperial Dams Under a Plan of Implementation Scenario When 1.63 Million Tons of Salinity Control has been Implemented.

	TDS With Plan of Implementation 1.63 MT				
Year	Hoover	Parker	Imperial		
2035	621	641	759		
	Annual Damages by Location			Total Damages	Annual Benefits
2035	$34,157,000	$204,809,000	$306,090,000	$545,056,000	$69,466,000

Estimated 2035 Damages with Plan of Implementation, 1.68 Million Tons of Salt

TDS values for a "with" project condition were estimated by the CRSS Model for 2035 when 1.68 million tons of salt will be controlled by the Plan of Implementation. Annual damages for 2035 were estimated by the Salinity Damage Model. Annual benefits were calculated by finding the difference in annual damages for similar years between the "without" project condition and the "with" project condition. Benefits from the Plan of Implementation come to $69.466 million ($614.522 million minus $531.124 million) for 2035.

Table 11 – Estimated TDS Values and Annual Damage Estimates for 2035 at Hoover, Parker, and Imperial Dams Under a Plan of Implementation Scenario When 1.68 Million Tons of Salinity Control has been Implemented.

	TDS With Plan of Implementation 1.68 MT				
Year	Hoover	Parker	Imperial		
2035	617	637	754		
	Annual Damages by Location			Total Damages	Annual Benefits
2035	$33,027,000	$198,049,000	$300,048,000	$531,124,000	$83,398,000

Science Team

To further improve and expand our knowledge of salinity control methods, data, and modeling within the Colorado River basin, the Salinity Science Team was created. This team incorporates technical experts and coordinators from each Federal agency (Reclamation, USDA, NRCS, BLM, and USGS) that provides salinity data and/or modeling and the Forum's Executive Director. For more information on the Science Team, please refer to the last section of the USGS Chapter in the 2006 FAR.

The following are some of the topics that were addressed by the Science Team during meetings held in February and August 2014:

1. Lower Gunnison and Uinta Basins Planning Studies
2. Evaluation of rangeland salt sources
3. Paradox Valley Unit – current operations, Maximum Allowable Surface Injection Pressure (MASIP) Consultant Review Board (CRB), Evaporation Pond CRB, Pilot Evaporation Pond Study, Alternative Study and Environmental Impact Statement.
4. Review of Research, Studies, and Investigations (RSI) proposals for funding and recommending to the Advisory Council's Technical Advisory Group (TAG) which proposals should receive funding.
5. Reports on awarded RSI proposals
6. Pah Tempe Study
7. Knowledge gaps in rangeland salt loading
8. How BLM reports tons of salt control
9. Future science direction and needs and priorities
10. Reclamation's Acquisition Process
11. Update Parette Draw Work
12. Salinity Bible
13. Calculation of Damages/ton of salt
14. 3rd International Salinity Forum
15. NRCS M&E Summary Report
16. Groundwater Changes in the Colorado River Basin
17. Uinta Basin Wheel Lines, May 8, 2007, Report by Bob Hill

Basinwide Salinity Control Program (Basinwide Program)

Price – San Rafael River Basins, Utah

Huntington Cleveland Irrigation Company (HCIC) Project: The Project is located in northern Emery County, in and around the towns of Huntington, Lawrence, Cleveland, and Elmo. The Project was selected in the 2004 Request for Proposals (RFP) and awarded a cooperative agreement in September 2004. A new cooperative agreement was executed in November 2006, and was modified again in September 2009. Approximately 350 miles of open earthen canals and laterals are being replaced with a pressurized pipeline distribution system (Distribution System) to accommodate sprinkler irrigation on about 16,000 acres. Funding for this project is being shared between Reclamation's Basinwide Program, HCIC, NRCS's EQIP, the Parallel Program, and Rocky Mountain Power, formally known as Utah Power and Light. The last of Reclamation's share of $17,116,336 for the Off-farm Distribution System was obligated in 2008. Reclamation can provide up to an additional $6,000,000 in funding equally 50/50 with HCIC funds for completion of the Distribution System. Since 2009, Reclamation has provided over $4,000,000 in additional funding. The Project, scheduled to be completed in 2015, will result in the annual reduction of 59,000 reportable tons of salt in the Colorado River at an anticipated cost of approximately less than $100/ton. Of the 59,000 tons of salt, 13,000 are attributed to the Off-Farm Distribution System and 46,000 tons are attributed to the On-Farm Distribution System and the on-farm salinity control measures (sprinklers).

Cottonwood Creek Irrigation Improvement Project: The $6,509,548 Cottonwood Creek Irrigation Improvement Project is located in Emery County, west of Castledale, Utah. It was selected from the applications received in the 2008 FOA. A cooperative agreement was executed in February 2010. Construction began in May 2011, and the project was operational for the 2013 irrigation season. This project replaced approximately 31 miles of earthen canals and laterals with a pressurized pipeline system resulting in a reduction of 2,094 reportable tons of salt in the Colorado River. It is expected that the pressurized pipeline will induce on-farm improvements resulting in the annual reduction of an additional 9,100 reportable tons of salt. It is anticipated that the project will result in the total annual reduction of 11,194 reportable tons of salt in the Colorado River at an anticipated cost of approximately $59 per ton of salt. Construction is complete and the canals will be taken out of service in the fall of 2015 when all of the farms will be converted to sprinkler irrigation.

Blue Cut/Mammoth Unit, Cottonwood Creek Consolidated Irrigation Company Salinity Project: The $5,500,000 Blue Cut/Mammoth Unit, Cottonwood Creek Irrigation Company Irrigation Project was selected from the applications received in the 2012 FOA. A cooperative agreement was executed in August 2013. The Blue Cut phase has completed construction and is awaiting on-farm improvements. The Mammoth phase of this project is in the design phase with construction expected to begin by December of 2014. This project will replace approximately 45.6 miles of earthen canals and laterals with a pressurized pipeline system resulting in the reduction of 3,789 reportable tons per year of salt in the Colorado River at an anticipated cost of approximately $67.57 per ton of salt. The pressurized pipeline will serve 5,680 acres resulting in additional on farm salt savings.

Uintah Basin, Utah

Hancock-State Road Salinity Reduction Project: This project is located in Duchesne and Uintah Counties in the vicinity of Roosevelt, Utah. It was selected from the applications received in the 2010 FOA and funded with funding from the Basin States Program. A Cooperative Agreement was executed in March of 2012, for the amount of $2,315,250. This project will replace approximately 20.83 miles of earthen canal and laterals with irrigation pipe resulting in the annual reduction of 1,759 reportable tons of salt in the Colorado River at an anticipated cost of approximately $65.25 per ton of salt. The project was begun in the fall of 2011 and approximately 50 percent was in service for the 2012 irrigation season. Project is now completed.

Manila-Washam Salinity Area, Utah

South Valley Lateral Salinity Project: This project is located in Daggett County south of the town of Manila, Utah. It was selected from the applications received in the 2012 FOA and was submitted by the Sheep Creek Irrigation Company. A cooperative agreement was executed in May of 2013, for the amount of $4,026,264.75. This project will replace approximately 27,400 feet of earthen laterals with irrigation pipe resulting in the annual reduction of 3,373 reportable tons of salt in the Colorado River at an anticipated cost of approximately $55.57 per ton of salt. The project will begin in the fall of 2014. Project completion is scheduled for spring of 2016.

Big Sandy Project, Sweetwater County, in the vicinity of Farson and Eden, Wyoming

Eden Valley, Farson/Eden Pipeline Project: This project was selected in the 2008 FOA. A Cooperative Agreement was executed in February of 2009, for the amount of $6,453,072. This project will replace approximately 24 miles of earthen laterals with irrigation pipe resulting in the annual reduction of 6,594 reportable tons of salt in the Colorado River at an anticipated cost of approximately $52.57 per ton of salt. Laterals E-7, E-8, and E-13 are completed, and work on the West Side Canal was completed and operational in the spring of 2014. Some habitat work is still pending.

West Blacks Fork Salinity Area, Wyoming

Austin/Wall Off-Farm Irrigation Project: This project is located in Uintah County in the vicinity of Lyman, Wyoming. It was selected from the applications received in the 2012 FOA and was submitted by the Austin/Wall Irrigation District. A cooperative agreement was executed in May 2013, for the amount of $1,350,000. This project will replace approximately 32,000 feet of earthen canal and laterals with irrigation pipe resulting in the annual reduction of 1,092 reportable tons of salt in the Colorado River at an anticipated cost of approximately $57.55 per ton of salt. The project is scheduled to begin construction in the fall of 2014, and be completed in the spring of 2015.

Gunnison Basin, Colorado

Uncompahgre Valley Water Users Association (UVWUA) Phase 5 Project: As a result of the 2010 FOA, the UVWUA was awarded a $4.3 million cooperative agreement for Phase 5 of the East Side Lateral (ESL). This phase involves an additional 19 miles of laterals under the Selig and East Canal systems and the reduction of about 5,034 tons of salt loading annually. Construction began in November 2011 and will continue through 2015.

UVWUA Phase 7 Project: As a result of the 2010 FOA, the UVWUA was awarded a $3.2 million cooperative agreement for Phase 7 of the ESL. This phase involves an additional 12.7 miles of laterals under the Selig and East Canal systems and the reduction of about 3,029 tons of salt loading annually. Construction began in the fall of 2012 and will continue through 2016.

UVWUA Phase 8 – East Side Laterals Project (ESL): As a result of the 2012 FOA, the UVWUA was selected to be awarded a $3.5 million cooperative agreement for Phase 8 of the ESL. This phase involves an additional 14.1 miles of laterals under the South Canal, East Canal and the Loutzenhizer systems and the reduction of about 3,307 tons of salt loading annually. The cooperative agreement was executed in FY 2014, with construction to begin in the summer of 2015, and continuing through 2016.

Lower Stewart Pipeline Project: Awarded from the 2010 FOA, this project involves piping a portion of the Stewart Ditch & Reservoir Company (SDRC) existing unlined canals in a tributary to the North Fork of the Gunnison River near Paonia, Colorado. In September 2011, Reclamation entered into an agreement to provide up to $6.0 million to pipe 11.5 miles of existing canals with an expected salt load reduction of about 5,892 tons/year. Construction began in the fall of 2012, with an anticipated completion the winter of 2014/15.

Minnesota Ditch Irrigation Salinity Control – Project 1: Awarded from the 2010 FOA, this project involves piping a portion of the Minnesota Canal & Reservoir Company (MCRC) existing unlined canals in a tributary to the North Fork of the Gunnison River near Paonia, Colorado. In September 2011, Reclamation entered into an agreement to provide up to $3.94 million to pipe 5.2 miles of existing canals with an expected salt load reduction of about 1,364 tons/year. Construction began in the fall of 2012 and was substantially complete in the spring of 2013. Minor items were completed in fall of 2013.

Minnesota Canal Salinity Control Piping Project Phase II: Awarded from the 2012 FOA, this project involves piping the Minnesota Extension portion of the Minnesota Canal & Reservoir Company (MCRC) existing unlined canals in a tributary to the North Fork of the Gunnison River near Paonia, Colorado. In June of 2013, Reclamation entered into an agreement to provide up to $3.03 million to pipe 3.8 miles of existing canals with an expected salt load reduction of about 2,328 tons/year. Construction will begin in the fall of 2014 with an anticipated completion in 2015.

C Ditch/ Needle Rock Project: Awarded from the 2010 FOA, this project involves piping a portion of the C Ditch Company (CDC) existing unlined ditches in a tributary to the Cottonwood Creek drainage of the Gunnison River near Crawford, Colorado. In July 2012, Reclamation

entered into an agreement to provide up to $1.43 million to pipe 2.5 miles of existing ditches with an expected salt load reduction of about 714 tons/years. Construction began in the fall of 2013 and is substantially complete.

Clipper Irrigation Salinity Control – Project 4: Awarded from the 2010 FOA, this project involves piping a portion of the Crawford Clipper Ditch existing unlined canals in a tributary to the Cottonwood Creek drainage of the Gunnison River near Hotchkiss, Colorado. In September 2012, Reclamation entered into an agreement to provide up to $1.21 million to pipe 3.5 miles of existing canals with an expected salt load reduction of about 1,427 tons/year. Construction is anticipated to begin in the fall of 2014.

Slack/Patterson Laterals Piping Project: Awarded from the 2012 FOA, this project involves piping of the Slack and Patterson Laterals portion of the Roger's Mesa Water Distribution Association's existing, unlined laterals supplied by Fire Mountain Canal and Leroux Creek, a tributary to the North Fork of the Gunnison River near Hotchkiss, Colorado. In June 2013, Reclamation entered into an agreement to provide up to $3.39 million to pipe 9.1 miles of existing laterals with an expected salt load reduction of about 3,345 tons/year. Construction will begin in the fall of 2014 with an anticipated completion in 2016.

Cattleman's Harts, Hart/McLaughlin, Rockwell, Poulsen Ditch's: Awarded from the 2012 FOA, this project involves piping a portion of the Cattleman's earthen laterals, operated by the Cedar Canyon Iron Springs Irrigation Company and supplied by Crystal Creek, a tributary to the Gunnison River near Crawford, Colorado. In July 2013, Reclamation entered into an agreement to provide up to $2.01 million to pipe 6.3 miles of existing laterals with an expected salt load reduction of about 1,855 tons/year. Construction will begin in the fall of 2014 with an anticipated completion in 2016.

Several iterations of salt load studies have evolved in the North Fork area of the Lower Gunnison Basin over the years. Subsequent iterations are based on new data and techniques that allow for more accurate estimates of off-farm salt loading. Based on these changes, some of the salt load estimates for the above projects have been revised from their original estimates to values based on the current version of the USGS LowGunS Model.

In order to complete the Lower Gunnison Basin mapping project, Reclamation submitted a funding modification in 2013 to the existing, financial assistance agreement with the Colorado State Soil Conservation Board. This additional funding is being used to complete the remaining, off-farm ditch mapping in the Colona and Ridgway areas. In cooperation with irrigation entities, quality assurance checks are also being performed on previously mapped and newly mapped systems in the Lower Gunnison Basin. Both tasks are anticipated to be completed in the winter of 2014/15.

Grand Valley, Colorado

Grand Valley Irrigation Company (GVIC) Canal Improvement Grant 2010: As a result of selection under the 2010 FOA, the GVIC was awarded a $2.8 million cooperative agreement to line about 1.9 miles of their main canal and pipe about 4,100 ft. of ditch within the Grand Valley.

A salt loading reduction of approximately 1,749 tons annually is expected. The canal lining will consist of a PVC membrane with a shotcrete cover and the pipe will be concrete. Construction began in December 2011, and will continue through 2015.

Grand Valley Irrigation Company (GVIC) Canal Improvement Grant 2012: As a result of selection under the 2012 FOA, the GVIC was selected to be awarded a $4.9 million cooperative agreement to line about 2.4 miles of their main canal within the Grand Valley. A salt loading reduction of approximately 4,001 tons annually is expected. The canal lining will consist of a PVC membrane with a shotcrete cover. The cooperative agreement was executed in FY 2014 and construction will begin in December 2014, and will continue through 2017.

Paradox Valley Unit (PVU), Colorado

This project intercepts extremely saline brine (260,000 mg/l total dissolved solids) before it reaches the Dolores River and disposes of the brine by deep well injection (injection interval about 14,000 feet below ground surface).

Induced seismicity and the increasing pressure necessary to inject the brine into the disposal formation at 14,000' are the limiting factors of the project. As the formation fills with brine, the pressure necessary to inject increases (Table 5). As the pressure increases, the potential for increased seismicity may exist. In January 2013, a M4.4 earthquake occurred that caused Reclamation to modify injection operations which included a new shut down schedule and injection rate reduction. Those modifications have significantly decreased the injection pressure which could result in additional life of the well. The current projected life of the well remains at 3 to 5 years.

The project continues to intercept and dispose of 100,000+ tons of salt annually.

Alternative Study

At the request of the Salinity Control Forum, Reclamation began exploring and development of a pilot study to evaluate evaporation ponds as a viable method for salt disposal at Paradox. In 2014, Reclamation continued to have meetings and discussion with the BLM, Service, EPA, and Colorado Department of Public Health and Environment. Major issues continue to be compliance with the Migratory Bird Treaty Act, permitting requirements for disposal of the brine evaporate and pond liner, and high levels of hydrogen sulfide. Initial cost estimates are dependent on site selection and environmental regulatory requirements. Reclamation continues to work to find a suitable site for the pilot study and refine cost estimates. Implementation of the pilot study may also be dependent on obtaining a land withdrawal from BLM.

Reclamation also began the process of beginning an alternative study/environmental impact statement for alternatives to replace the existing injection well. A Notice of Intent was published in the Federal Register on September 10, 2012 and public scoping meetings were held in Paradox, Montrose, and Grand Junction in 2012. Reclamation prepared a Scoping Summary Report in early 2013.

Table 12 – Paradox Well Injection Evaluation

Injection Period	Operational Days[1]	Pressure Start	High Pressure During Period	Injection Period Net Pressure Change	Tons of Salt Injected[2]	No. of Induced Seismic Events	Maximum Magnitude of Induced Seismic Events	Estimated Tons of Salt Entering the River[3]
Jan-May '02[4]	148	1609	4432		52,860	25	2.9	8,469
June-Dec '02[5]	178	929	4593	161	58,953	34	2.2	8,333
Jan-May '03[5]	144	1172	4627	34	53,173	27	2.1	18,037
June-Dec '03[5]	184	1154	4675	48	59,530	106	2.3	11,185
Jan-May '04[6]	140	1201	4640	-35	51,449	47	2.4	20,225
June-Dec '04[7]	160	1091	4541	-99	51,589	57	3.9	6,442
Jan-May '05[5]	140	1038	4736	195	55,024	69	2.4	14,011
June-Dec '05[8]	148	1203	4750	14	46,551	31	2.6	38,582
Jan-June '06[9]	138	375	4680	-70	44,779	10[10]	2.4	53,039
July-Dec '06[5]	162	1084	4797	117	56,920	13[10]	2.1	18,605
Jan-June '07[5]	159	1066	4796	-1	56,068	7[10]	1.1	19,728
July-Dec '07[5]	163	1232	4712	-84	57,395	31	2.6	11,279
Jan-June '08[11]	160	1152	4813	101	54,720	47	1.3	15,305
July-Dec '08[5]	162	1263	4822	9	56,734	61	2.1	16,378
*Jan-Mar '09[5]	84	1246	4756	-66	29,163	20	2.6	22,029
Apr-Sept '09[12]	160	1157	4891	135	55,083	70	2.7	16,507
Oct '09-Mar '10[5]	153	970	4930	39	51,589	91	2.9	32,876
Apr '10-Sep '10[5]	162	1347	4990	60	55,747	75	2.7	17,223
Oct '10-Mar '11[5]	161	1378	5000	10	55,501	43	2.9	22,916
Apr '11-Sep '11[13]	158	1276	5102	102	54,422	63	2.7	11,591
Oct '11-Mar '12	162	1282	5115	6	56,531	59	2.5	21,003
Apr '12-Sep '12	161	1417	5108	-7	55,605	116	1.9	5,507

1 Operational days include partial days of operation which accounts for variations in tons of salt injected
2 Tons of salt injected based on 260,000 mg/L. Brine concentration varies slightly due to seasonal and environmental fluctuations.
3 Tons of salt entering the river based on regression equations (Ken Watts, USGS Administrative Report – "Estimates of Dissolved Solids Load of the Dolores River in Paradox Valley, Montrose County, CO, 1988-2009, August 5, 2010"). The 2010 FAR contained erroneous estimated tons of salt entering the river.
4 Begin 100% brine injection
5 No problems
6 Down from 3/1/04 through 3/7/04 for mechanical problems
7 Implemented quarterly 10-day shutdown schedule from 9/22 to 10/22; M3.9 earthquake on 11/7; plant shut down until 11/18; discontinued 10-day shutdown schedule
8 Down from 11/13/05 through 12/31/05 for mechanical problems
9 Down from 1/1/06 through 1/19/06 and 2/16/06 through 3/2/06 for mechanical problems
10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems
10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems
10 Seismic data for 2006 and the first half of 2007 is likely incomplete due to seismic network problems
11 Down from 4/16-17/08 for mechanical problems
12 Down from 5/18-19/09 for mechanical problems
13 Down from 9/18-9/20 for communication link failure.

* Biannual shutdown schedule changed from winter/summer to spring/fall

2013 - 2014

Injection Month	Min Injection Pressure	Max Injection Pressure	Monthly Pressure Change	Tons of Salt Injected[1]	# of Induced Seismic Events[2]	Max Mag of Seismic Events	Estimated Salt Load in tons[3]	Comments
Jan-13	2,733	5,111		8,115	23	4.4	263	January 23 M4.4 Earthquake - Shut Plant Down 1/23/13 - 2200 hours; Injection rate prior to earthquake was 230gpm, shut down schedule was two - twenty day shut downs annually
Feb-13	893	2,733	-2,378	0	9	1.7	1,324	Plant Down
Mar-13	500	893	-1,840	0	41	1.2	2,600	Plant Down
Apr-13	390	500	-393	4,064	9	0.7	3,351	Start up on April 17 after January 23 M4.4 earthquake. Begin 33 hour weekly shut down schedule and continue to use 2.125" plungers until new 2" plungers are installed.
May-13	3,290	4,452	3,952	8,752	13	1.8	1,535	33 hour weekly shut down schedule, 2.125" plungers
Jun-13	3,948	4,685	233	8,311	7	0.8	2,089	Continued 2.125" plungers to June 5 - Installed 2" plungers on June 5, began 18 hour shut down schedule on June 11
Jul-13	4,143	4,740	55	8,457	5	1.2	1,823	No Problems
Aug-13	4,218	4,710	-30	8,629	4	0.5	289	No Problems
Sep-13	3,513	4,770	60	7,557	2	0.3	659	PLC problems - plant down from 9/19 through 9/22. 18 hour weekly shut downs suspended from 9/22 to 11/12
Oct-13	3,683	4,770	0	9,610	6	1.2	195	No Problems
Nov-13	4,208	4,803	33	8,814	5	0.7	577	No Problems
Dec-13	4,195	4,758	48	8,713	6	0.8	778	No Problems
Jan-14	4,202	4,739	-19	8,584	2	0.3	681	No Problems
Feb-14	4,187	4,745	6	7,760	6	1.7	925	5 hour power outage on 2/27
Mar-14	4,193	4,757	12	8,713	4	1.5	1,283	No Problems
Apr-14	4,206	4,772	15	8,159	1	0.9	694	No Problems
May-14	4,215	4,775	3	8,711	7	1.2	90	No Problems

Jun-14	4,217	4,769	-6	8,381	0	N/A	226	No Problems
Jul-14	4,218	4,778	9	8,485	5	2.3	-203	No Problems
Aug-14	4,212	4,781	3	8,584	0	N/A	-1,116	No Problems
12 Month Totals thru Aug 14			11	102,071	44	2.3	4,789	

[1]Tons of salt injected based on 260,000 mg/l. PVB concentration varies slightly due to seasonal and environmental fluctuations.

[2]See Seismicity Notes tab

[3]Estimated salt load based on regression equations (Ken Watts, USGS Administrative Report - "Estimates of Dissolved Solids Load of the Dolores River in Paradox Valley, Montrose County, Colorado, 1988 through 2009, dated August 5, 2010") and provisional data provided by USGS. Some daily EC and stream flow discharge values are estimates. See Salt Load Notes tab.

Basin States Program (BSP)

Public Law 110-246 amended the Act creating the BSP to be implemented by the Secretary of Interior through Reclamation. Section 205(f) of the Act was amended to provide that cost share obligations be met through an up-front cost share from the Basin Funds. The amendment also authorizes Reclamation to expend the required cost share funds through the BSP for salinity control activities established under Section 202(a)(7) of the Act.

Reclamation has determined that agencies within the upper Basin states to be appropriate partners and has executed cooperative agreements to utilize the services of these state agencies to assist in seeking and funding cost-effective activities to reduce salinity in the Colorado River system. Activities will also benefit the upper Basin states by improving water management and increasing irrigation efficiencies. Interagency agreements have been executed with the NRCS in the states of Colorado and Utah to provide the technical assistance for the BSP.

Utah Department of Agriculture and Food (UDAF)

With the Basin States Program agreement in place with Reclamation, UDAF working through NRCS's EQIP program has funded 3 projects for $3,452,009.00. One project came to UDAF through Reclamation's FOA. This project is with Sheep Creek Irrigation Company, Manila, Utah and is canal piping project that will retain 2,220 tons of salt per year at a cost of $2,897,129.18. The other projects will treat 417 acres and control 1,083 tons of salt with a combined cost of $471,879.00. All 3 projects are essentially completed with minor clean-up and restoration planting in Sheep Creek and Irrigation Water Management for the on farm work.

As requested by Reclamation UDAF also has contracted with Emery County Water Conservancy District for data collection of a long term study at Desert Lake, Emery County, and services for a local liaison between URS and residents in the Uintah Basin. This position will assist the Uintah Basin Study identify where salinity dollars can be applied and how to get more program participation. Both these agreements will continue into the future as needed to collect data and provide local leadership in development of salinity projects. UDAF paid Emery County Water Conservancy $11,368.85 and Uintah basin salinity coordinator $16,491.34 during the past federal fiscal year.

Colorado State Conservation Board (CSCB)

In Colorado, the Basin States Program (BSP) is delivered through six local Conservation Districts that operate within the boundaries of the approved salinity control areas in the state. These salinity control areas include the Silt Mesa, Grand Valley, Lower Gunnison, McElmo Creek, and Mancos River salinity areas. The Bookcliff, Mesa, Delta, Shavano, Dolores, and Mancos Conservation Districts receive funds from the CSCB that in turn receives Financial Assistance (FA) funding based upon a contract agreement with Reclamation.

The Districts enter into agreements with individual landowners and entities to install approved salinity control projects and/or wildlife replacement projects within salinity control area

boundaries. The projects are planned, designed and certified by NRCS or District employees. Thirteen District employees are paid from BSP Technical Assistance (TA) funding earned by NRCS in Colorado and provided to the CSCB and Conservation Districts.

All projects are planned, designed and certified based upon current NRCS Standards and Specifications. Each participant signs an Operation and Maintenance agreement to remain in effect for the life of the irrigation and wildlife improvements installed (usually 25 years). Each participant is required to perform proper Irrigation Water Management on the fields in which irrigation improvements were installed. Participants receive a financial incentive for performing Irrigation Water Management.

The CSCB follows planning and contracting procedures in place for the Environmental Quality Incentives Program (EQIP). The projects are planned and contracted using the current NRCS EQIP payment schedule.

Applications are competitively screened and prepared by the NRCS. Applications are funded in order of the best cost effectiveness. All applications meeting NRCS planning standards that result in an annualized cost per ton of less than $150/ton and that were also not eligible for EQIP are considered for funding depending upon funds available. The cost effectiveness and salt loading data used for these calculations are standardized for all salinity control areas in Colorado by the NRCS.

Upon approval of the application, the District enters into a contract with the applicant for irrigation and/or wildlife improvements based on the current NRCS payment rate. Upon completion of the project, the NRCS certifies the installation, and the District provides a payment to the landowner or entity. CSCB periodically requests reimbursement from Reclamation for these payments.

Progress

BSP projects

Reclamation has provided $2,834,000 in funding to CSCB. To date, $ 1,239,206 has been obligated for nine EQIP-like BSP projects. These projects will result in salt control of 2155.9 tons and treat and/or serve 611.5 acres at an average cost effectiveness of $51.37/ ton. One of the approved projects is a wildlife habitat improvement project. Two projects were approved in the Grand Valley area, and seven projects were approved in the Lower Gunnison area.
Five of the above projects are complete, including the wildlife project. All structural items for the other four are complete, with only irrigation water management items remaining to be completed.

Grand Valley Wildlife Project: The CSCB has contracted with Colorado Parks and Wildlife (CPW) to fund approximately 491 acres of wildlife improvements along the Colorado River in the Grand Valley for a cost of $804,415, utilizing BSP special funding received from Reclamation in 2013. This project is expected to begin construction in October, 2014. This project has been planned and designed as a joint effort with CPW, FWS, and NRCS.

Completion of this project will satisfy the remaining acres of replacement habitat required in the Grand Valley salinity unit.

Reclamation Funding Opportunity Announcement (FOA) Projects

CSCB was pleased to be involved in the FOA process. The expansion of the ranking and selection criteria to include projects from 300 tons of salt control to 1000 tons of salt control has allowed more coordination with EQIP and BSP on-farm salinity control improvements. CSCB has contracted with three of the Reclamation projects approved through the FOA process, for a total cost of approx. $2.3M.

The Forked Tongue/Holman Ditch Project is in the final design stage and is anticipated to start construction in winter 2014. Design is completed for the Bostwick Park Project, and construction will begin in October 2014. The Clipper-Zanni Project is currently being designed.

Ditch Mapping: CSCB received $ 34,000 in BSP funding this year to complete ditch mapping activities in Ouray County in the Lower Gunnison area, and to review and complete data for ditch mapping previously completed in other portions of the Lower Gunnison area. This project is currently underway.

Summary Data
Colorado River Basin Salinity Control Program

The Summary Tables of the Federal Salinity Control Programs are attached in separate pdf files.

FY - 2014

Basin States Program

		9/30/2014
Lower Basin Fund Request	**$**	**8,139,052**
Upper Basin Fund Request	**$**	**1,765,643**
Carry Over in the BSP (already withdrawn)	**$**	**723,700**
Carry Over in the BWP& O&M (already withdrawn)	**$**	**2,187,772**
TOTAL	**$**	**12,816,167**

PROJECTS FY 2014		**Upper Basin**	**Lower Basin**	
Basinwide Program	**$ (2,614,286)**	**$ (392,143)**	**$ (2,222,143)**	
Salinity O&M Projects	**$ (1,670,237)**	**$ (250,536)**	**$ (1,419,701)**	
Yearly BSP Projects				
RiverWareIDIQ	$ (18,000)	$ (2,700)	$ (15,300)	
Mod Option Yr 1 - U of Colorado	$ (6,250)	$ (938)	$ (5,313)	
Upper Colorado River Streamgaging	$ (310,690)	$ (46,604)	$ (264,087)	
NRCS CO	$ (943,322)	$ (141,498)	$ (801,824)	
NRCS UT	$ (849,098)	$ (127,365)	$ (721,733)	
NRCS WY	$ -	$ -	$ -	
STATE OF CO - BSP	$ -	$ -	$ -	
STATE OF UT - BSP	$ (1,725,000)	$ (258,750)	$ (1,466,250)	
STATE OF WY - BSP	$ -	$ -	$ -	
SIR - PROJECTS	$ (505,000)	$ (75,750)	$ (429,250)	
US-F&WS - BSP	$ (41,181)	$ (6,177)	$ (35,004)	
Reclamation T/A	$ (100,000)	$ (15,000)	$ (85,000)	Estimated
Advisory Council Members' Travel	$ (5,000)	$ (750)	$ (4,250)	Estimated
End of year Accounting (will be final on 9/30/2014)	$ 92,708	$ 13,906	$ 78,802	
BSP Projects Selected in the 2010 FOA				
Uncompahgre Phase 7 - 2010 FOA - Ends in FY 2015	$ (800,000)	$ (120,000)	$ (680,000)	
Dry Gulch/State Road - 2010 FOA - Ends in FY 2014	$ (100,000)	$ (15,000)	$ (85,000)	
		$ -	**$ -**	
		$ -	**$ -**	
		$ -	**$ -**	
TOTAL	$ (9,595,356)	$ (1,439,303)	$ (8,156,053)	

Total Basin Funds	**$**	**12,816,167**
Total Basin Fund Expenditures	**$**	**(9,595,356)**
Total Amount to be carried over in the Basin States Program	**$**	**3,220,811**

FY - 2015

Basin States Program

12/18/2014

Lower Basin Fund Request	**$ 6,300,000**	**Estimated**	
Upper Basin Fund Request	**$ 1,785,000**	**Estimated**	
Carry Over in the BSP (already withdrawn)	**$ 3,220,811**	**Estimated**	
TOTAL	**$ 11,305,811**		

PROJECTS FY 2015	Total BSP	Upper Basin	Lower Basin	
Basinwide Program	**$ (2,725,714)**	**$ (408,857)**	**$ (2,316,857)**	
Salinity O&M Projects	**$ (1,800,000)**	**$ (270,000)**	**$ (1,530,000)**	Estimated
Yearly BSP Projects				
RiverWareIDIQ	$ (18,000)	$ (2,700)	$ (15,300)	
Mod Option Yr 2 - U of Colorado	$ (50,000)	$ (7,500)	$ (42,500)	
Upper Colorado River Streamgaging	$ (544,425)	$ (81,664)	$ (462,761)	Estimated
NRCS CO	$ (985,352)	$ (147,803)	$ (837,549)	Estimated
NRCS UT	$ (900,000)	$ (135,000)	$ (765,000)	Estimated
NRCS WY	$ (41,000)	$ (6,150)	$ (34,850)	Estimated
STATE OF CO - BSP	$ (1,000,000)	$ (150,000)	$ (850,000)	Estimated
STATE OF UT - BSP	$ (900,000)	$ (135,000)	$ (765,000)	Estimated
STATE OF WY - BSP	$ (300,000)	$ (45,000)	$ (255,000)	Estimated
SIR - PROJECTS	$ (525,000)	$ (78,750)	$ (446,250)	Estimated
Reclamation T/A	$ (125,000)	$ (18,750)	$ (106,250)	Estimated
Advisory Council Members' Travel	$ (5,000)	$ (750)	$ (4,250)	Estimated
BSP Projects Selected in the 2010 FOA				
Uncompahgre Phase 7 - 2010 FOA - Ends in FY 2015	$ (1,383,983)	$ (207,597)	$ (1,176,386)	
		$ -	**$** -	
		$ -	**$** -	
		$ -	**$** -	
TOTAL	$ (11,303,474)	$ (1,695,521)	$ (9,607,953)	

Total Basin Funds	**$ 11,305,811**
Total Basin Fund Expenditures	**$ (11,303,474)**
Total Amount to be carried over in the Basin States Program	**$ 2,337**

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Upper Colorado River Basin Fund

As of 9/30/2014

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Repayment																		
				Grand Valley															
Fiscal	Paradox Valley Unit			Construction Completed								Las Vegas	Lower Gunnison		McElmo Creek (Dolores Project)		USDA	**Total Transfer to**	
Year	Well	Facilities	O&M	Sep-89	Sep-92	Sep-93	Sep-97	Sep-98	Sep-99	Total	O&M	Wash	Construction	O&M	Construction	O&M	NRCS	**Treasury**	Year
1987											2,013						4,905	6,918	1987
1988			973								2,545						86,570	90,088	1988
1989			4,454								914						105,163	110,531	1989
1990			7,190								3,675						146,071	156,936	1990
1991			9,659								4,317					2,269	183,802	200,047	1991
1992			17,701								4,418			10,301		2,321	266,734	301,475	1992
1993			16,011								11,012			11,000		5,230	408,072	451,325	1993
1994			18,457								2,152			15,865		1,917	319,296	357,687	1994
1995			29,749								14,647		1,405,078	16,021		8,845	460,114	1,934,454	1995
1996			90,326								24,860		-7,680	18,525	2,464,892	13,657	145,568	2,750,148	1996
1997			80,337								22,645		675	18,774	21,829	12,613	128,770	285,643	1997
1998			70,676								18,704		-43	19,188	10,658	16,483		135,666	1998
1999													59,331		28,273			87,604	1999
2000																		0	2000
2001																		0	2001
2002																		0	2002
2003																		0	2003
2004																		0	2004
2005																		0	2005
2006																		0	2006
2007																		0	2007
2008																		0	2008
2009																		0	2009
2010																		0	2010
2011																		0	2011
2012																		0	2012
2013																		0	2013
2014																		0	2014
Subtotal	0	0	345,533	0	0	0	0	0	0	0	111,902	0	1,457,361	109,674	2,525,652	63,335	2,255,065	6,868,522	
2015	0	0		0	0	0	0	0	0	0								0	2015
2016	0	0		0	0	0	0	0	0	0								0	2016
2017	0	0		0	0	0	0	0	0	0								0	2017
2018	0	0		0	0	0	0	0	0	0								0	2018
2019	0	0		0	0	0	0	0	0	0								0	2019
2020	0	0		0	0	0	0	0	0	0								0	2020
2021	0	0		0	0	0	0	0	0	0								0	2021
2022	0	0		0	0	0	0	0	0	0								0	2022
2023	0	0		0	0	0	0	0	0	0								0	2023
2024	0	0		0	0	0	0	0	0	0								0	2024
2025	0	0		0	0	0	0	0	0	0								0	2025
2026	1,402,063	0		0	0	0	0	0	0	0			-421		-17,328			1,384,314	2026
2027		0		0	0	0	0	0	0	0								0	2027
2028		0		0	0	0	0	0	0	0								0	2028
2029		0		0	0	0	0	0	0	0								0	2029
2030		0		0	0	0	0	0	0	0								0	2030
2031		0		0	0	0	0	0	0	0								0	2031
2032		0		0	0	0	0	0	0	0								0	2032
2033		0		0	0	0	0	0	0	0								0	2033
2034		0		0	0	0	0	0	0	0								0	2034
2035		0		0	0	0	0	0	0	0								0	2035
2036		0		0	0	0	0	0	0	0								0	2036
2037		0		0	0	0	0	0	0	0								0	2037
2038		0		0	0	0	0	0	0	0								0	2038
2039		0		3,200,008	0	0	0	0	0	3,200,008								3,200,008	2039
2040		0			0	0	0	0	0	0		64,747						64,747	2040
2041		0			0	0	0	0	0	0								0	2041
2042		0			347,605	0	0	0	0	347,605								347,605	2042
2043		0				158,454	0	0	0	158,454								158,454	2043
2044		0					0	0	0	0								0	2044
2045		0					0	0	0	0								0	2045
2046		1,071,189					0	0	0	0								1,071,189	2046
2047							209,719	1,059,717	650,148	1,919,584								1,919,584	2047
2048										0									2048
Total	1,402,063	1,071,189	345,533	3,200,008	347,605	158,454	209,719	1,059,717	650,148	5,625,651	111,902	64,747	1,456,940	109,674	2,508,324	63,335	2,255,065	15,014,423	

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Lower Colorado River Basin Development Fund (with delayed repayment of Original Units)

As of 9/30/2014

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Repayment																		
				Grand Valley															
	Paradox Valley Unit			Construction Completed								Las Vegas	Lower Gunnison		McElmo Creek		USDA	Transfer to	
Year	Well	Facilities	O&M	Sep-89	Sep-92	Sep-93	Sep-97	Sep-98	Sep-99	Total	O&M	Wash	Construction	O&M	Construction	O&M	NRCS	Treasury	Year
1988											11,410				17,402		27,797	56,609	1988
1989			5,511								14,424				160,515		490,562	671,012	1989
1990			25,242	165,039						165,039	5,178				176,194		595,923	967,576	1990
1991			40,744	165,366						165,366	20,826		683,908		685,579		827,733	2,424,156	1991
1992			54,736	167,566						167,566	24,461		1,018,031		1,022,056	12,857	1,041,545	3,341,252	1992
1993			100,304	170,951	30,755					201,706	25,037		1,800,250	58,374	1,791,857	13,151	1,511,481	5,502,160	1993
1994			90,727	170,982	33,049	65,779				269,810	62,403	36,690	1,481,236	62,335	3,508,286	29,635	2,312,460	7,853,582	1994
1995			104,588	170,982	34,063	66,016				271,061	12,198	7,338	1,265,024	89,901	2,263,383	10,861	1,809,345	5,833,699	1995
1996			523,452	318,081	35,023	66,024				419,128	172,501	11,439	151,911	150,538	407,689	97,918	2,641,054	4,575,630	1996
1997			156,978	23,861	35,347	66,033				125,241	51,373	3,237	45,361	45,222	122,133	29,592	791,145	1,370,282	1997
1998			307,790	171,053	35,713	66,038	134,568	313,270		720,642	108,753	7,338	382,343	61,102	616,036	75,921		2,279,925	1998
1999			52,534	171,053	39,952	66,043	134,689	491,475	58,629	961,841	105,987	7,338	-256		52,823			1,180,267	1999
2000				363,811	39,254	17,978	23,822	540,162	40,109	1,025,136		7,338	1,362		1,139			1,034,975	2000
2001				365,715	39,498	18,064	24,536	512,562	64,761	1,025,136		7,338	1,362		1,139			1,034,975	2001
2002				366,384	39,540	18,152	24,053	523,997	57,847	1,029,973								1,029,973	2002
2003				363,833	41,792	17,978	23,822	523,964	53,747	1,025,136		7,338						1,032,474	2003
2004				363,890	39,275	17,978	23,822	521,838	58,333	1,025,136		7,338						1,032,474	2004
2005				363,376	39,276	17,978	23,822	521,921	58,763	1,025,136		7,338						1,032,474	2005
2006	2,655,420	1,214,010		363,376	39,276	17,978	23,822	521,921	58,763	1,025,136		7,338						4,901,904	2006
2007	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338	-383,526		166,259			779,905	2007
2008	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338			-577,579			419,593	2008
2009	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2009
2010	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2010
2011	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2011
2012	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2012
2013	264,480	121,401		420,850	40,221	10,159	18,328	37,414	76,981	603,953		7,338						997,172	2013
2014																		0	2014
Subtotal	4,506,780	2,063,817	1,462,606	7,191,269	803,360	593,152	565,252	4,733,008	989,819	14,875,860	614,551	168,774	6,447,006	467,472	10,414,911	269,935	12,049,045	53,340,757	
2015																		0	2015
2016																		0	2016
2017																		0	2017
2018																		0	2018
2019																		0	2019
2020																		0	2020
2021																		0	2021
2022																		0	2022
2023																		0	2023
2024																		0	2024
2025																		0	2025
2026	3,438,424																	3,438,424	2026
2027																		0	2027
2028																		0	2028
2029																		0	2029
2030																		0	2030
2031																		0	2031
2032																		0	2032
2033																		0	2033
2034																		0	2034
2035																		0	2035
2036																		0	2036
2037																		0	2037
2038																		0	2038
2039				10,942,112						10,942,112								10,942,112	2039
2040												198,123						198,123	2040
2041																		0	2041
2042					1,166,404					1,166,404								1,166,404	2042
2043						304,754				304,754								304,754	2043
2044																		0	2044
2045																		0	2045
2046		4,006,254																4,006,254	2046
2047							623,154	1,272,056		1,895,210								1,895,210	2047
2048									2,694,352	2,694,352								2,694,352	2048
Total	7,945,204	6,070,071	1,462,606	18,133,381	1,969,764	897,906	1,188,406	6,005,064	3,684,171	31,878,692	614,551	366,897	6,447,006	467,472	10,414,911	269,935	12,049,045	77,986,390	

COLORADO RIVER BASIN SALINITY CONTROL PROGRAM TITLE II

Lower Colorado River Basin Development Fund

As of 9/30/2014

A	B	C	D	E	F	G	H	I	J	K	L	M
					Up-front Cost Sharing							
	Revenues											
Year	Hoover	Parker & Davis	Deficiency Payments	Repayment Transfer to Treasury	Paradox Valley O&M	Grand Valley O&M	McElmo Creek O&M	Lower Gunnison O&M	Basinwide SCP	NRCS SCP	Actual and Projected Transfer to UC Region	Actual LCRBDF Balance Available
1987	1,540,705											$ 1,540,705
1988	9,359,325		1,532,868	56,609								$ 9,310,553
1989	8,442,385		1,532,868	671,012								$ 15,549,058
1990	8,899,348		1,532,868	967,576								$ 21,947,962
1991	8,055,138		11,532,868	2,424,156								$ 16,046,075
1992	7,622,748		1,532,868	3,341,252								$ 18,794,703
1993	6,960,422		1,532,868	5,502,160								$ 18,720,097
1994	8,830,220		1,532,868	7,853,582								$ 18,163,867
1995	8,212,818		1,532,868	5,833,699								$ 19,010,118
1996	9,644,684		1,532,868	4,575,630								$ 22,546,304
1997	9,172,879		1,532,868	1,370,282					1,260,861	1,369,996	3,552,000	$ 25,264,033
1998	10,398,524		1,532,868	2,279,925	372,591	714,585	$147,535	145,192	2,761,600	745,497	4,887,000	$ 26,962,764
1999	10,908,408		730,073	1,180,267	456,513	283,405	121,398	116,000	4,553,355	702,891	6,215,000	$ 29,745,832
2000	10,410,325			1,034,975	694,295	243,648	100,965	237,000	4,381,470	8,246,380	13,783,000	$ 25,338,182
2001	10,255,846			1,034,975	590,422	144,067	111,673	0	3,930,282	(3,790,919)	1,100,000	$ 33,459,054
2002	8,674,271			1,029,973	551,075	279,945	84,315	121,000	4,185,740	1,802,338	6,966,000	$ 34,137,352
2003	8,202,777			1,032,474	415,795	242,999	131,908		3,112,520	6,982,687	10,885,000	$ 30,422,655
2004	8,307,425			1,032,474	503,133	210,236	123,866		3,477,560	6,789,712	11,104,000	$ 26,593,606
2005	6,700,765	448,360		1,032,474	538,836	183,366	158,644		3,003,036	2,697,956	6,581,000	$ 26,129,258
2006	8,174,033	1,462,305		4,901,904	514,658	259,884	188,166		3,086,351	8,349,941	12,399,000	$ 18,464,691
2007	8,008,373	1,418,252		779,905	559,423	284,756	106,582		3,256,500	6,464,739	11,544,000	$ 15,567,410
2008	7,842,785	1,478,287		419,593	769,452	239,037	142,334		2,908,339	6,276,838	10,336,000	$ 14,132,889
2009	7,574,720	1,547,288		997,172	1/ 663,166	1/ 373,546	1/ 153,600		1/ 6,294,926	1/ (7,485,238)	1/ 0	$ 22,257,725
2010	7,201,523	1,519,805		997,172	799,944	216,909	172,247		2,442,238	1,843,875	5,475,213	$ 24,506,669
2011	7,846,225	1,593,621		997,172	777,750	291,833	125,615		3,093,934	9,948,947	14,237,779	$ 18,711,564
2012	8,154,241	1,552,976		997,172	687,650	273,901	122,357		3,022,866	8,908,532	13,015,306	$ 14,406,303
2013	7,657,120	1,562,447		997,172	664,125	320,988	143,596		3,161,480	8,746,278	12,461,662	$ 10,167,037
2014	7,840,925	1,569,267		0	745,733	400,634	122,035		2,555,465	4,315,185	8,139,052	$ 11,438,178
Subtotal	215,400,911	11,020,893	27,591,621	53,340,757	8,894,703	4,242,117	1,991,205	619,192	54,771,578	59,854,172	144,541,960	
2015	7,340,417	1,556,356		0	767,833	425,000	122,035		2,664,385	6,329,465	6,300,000	$ 14,034,952
2016	7,434,613	1,556,356		0	1,107,833	510,000	122,035		3,068,378	6,888,643	9,200,000	$ 13,825,922
2017	7,291,996	1,556,356		0	767,833	510,000	122,035		3,068,378	6,495,852	9,200,000	$ 13,474,275
2018	7,268,923	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 13,099,554
2019	7,248,920	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 12,704,831
2020	7,042,824	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 12,104,012
2021	6,948,720	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 11,409,089
2022	7,095,182	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 10,860,628
2023	7,060,375	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 10,277,360
2024	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 9,655,955
2025	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 9,034,550
2026	7,022,239	1,556,356		3,438,424	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 4,974,722
2027	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 4,353,317
2028	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 3,731,913
2029	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 3,110,508
2030	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 2,489,103
2031	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 1,867,699
2032	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 1,246,294
2033	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 624,889
2034	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ 3,485
2035	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	6,375,000	9,200,000	$ (617,920)
2036	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (1,239,324)
2037	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (1,860,729)
2038	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (2,482,134)
2039	7,022,239	1,556,356		10,942,112	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (14,045,650)
2040	7,022,239	1,556,356		198,123	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (14,865,178)
2041	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (15,486,583)
2042	7,022,239	1,556,356		1,166,404	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (17,274,391)
2043	7,022,239	1,556,356		304,754	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (18,200,550)
2044	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (18,821,954)
2045	7,022,239	1,556,356		0	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (19,443,359)
2046	7,022,239	1,556,356		4,006,254	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (24,071,018)
2047	7,022,239	1,556,356		1,895,210	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (26,587,632)
2048	7,022,239	1,556,356		2,694,352	767,833	510,000	122,035		3,068,378	3,643,000	9,200,000	$ (29,903,389)
Total	694,742,041	79,642,580	55,183,242	133,321,491	46,333,236	26,734,757	8,519,588	1,238,384	222,203,826	323,501,299		

1/ Upfront cost sharing was created but not requested by the UC Region this year. Cost Share obligations were met by funds already sitting in the UC Region account, mostly from Unliqiudated Obligations in the Parallel Program.

FUNDING FORCAST FOR THE BASINWIDE PROGRAM

Date as of 9/30/2014

Project State	Contract Name	End Date	Contract Amount	Obligated to Date	Balance To Obligate	Expended to Date	Balance to Expend	FY 2014 Apporopriations & Cost Share + 15% End of year	FY 2015 Apporopriations & Cost Share	FY 2016 Apporopriations & Cost Share	FY 2017 Apporopriations & Cost Share
Wyoming	Farson/Eden Pipeline Pjct	**12/31/2014**	$ 6,453,072	$ 5,919,417	$ 533,655	$ 5,891,739	$ 27,678	$ 443,072	$ 300,000	$ -	
Colorado	Uncompahgre Eastside Lateral Phase 5	**12/31/2015**	$ 4,318,122	$ 4,318,122	$ -	$ 4,238,302	$ 79,820	$ 187,600	$ -	$ -	
Colorado	Lower Stewart Pipeline Project	**9/30/2015**	$ 6,000,000	$ 6,000,000	$ -	$ 5,209,079	$ 790,921	$ 575,500	$ -	$ -	
Colorado	Grand Valley - Canal Improvement (A)	**9/30/2015**	$ 2,819,228	$ 2,420,000	$ 399,228	$ 2,400,319	$ 19,681	$ -	$ -	$ 397,928	
Colorado	"C" Ditch/Needle Rock Project	**9/30/2015**	$ 1,434,885	$ 1,434,885	$ -	$ 1,371,254	$ 63,631	$ 334,885	$ -	$ -	
Colorado	Clipper Irrigation Project	**9/30/2015**	$ 1,214,140	$ 1,214,140	$ -	$ 184,710	$ 1,029,430	$ 114,140	$ -	$ -	
Colorado	UVWUA East Side Laterals Project Phase 8	**5/30/2017**	$ 3,542,157	$ 595,000	$ 2,947,157	$ 196	$ 594,804	$ 595,000	$ 1,200,000	$ 1,747,157	
Colorado	Minnesota Canal Piping Project Phase II	**9/30/2015**	$ 3,028,762	$ 2,100,000	$ 928,762	$ 633,916	$ 1,466,084	$ 1,700,000	$ 928,762		
Colorado	Slack/Patterson Laterals Piping Project - R-Mesa	**9/30/2015**	$ 3,394,427	$ 2,028,333	$ 1,366,094	$ 599,397	$ 1,428,937	$ 1,643,333	$ 1,366,094		
Colorado	Cattelman's Harts, Hart/McLaughlin, Rockwell, Poulsen Ditch's	**9/30/2015**	$ 2,007,225	$ 272,644	$ 1,734,581	$ 24,342	$ 248,302	$ -	$ 1,000,000	$ 734,581	
Colorado	GVIC Canal Improvement 2012	**9/30/2017**	$ 4,581,825	$ 400,000	$ 4,181,825	$ 191,270	$ 184,653	$ 400,000	$ 1,170,000	$ 1,880,000	$ 1,131,825
Wyoming	Austin/Wall Off-Farm Irrigation Project	**12/31/2015**	$ 1,350,000	$ 1,050,000	$ 300,000	$ 128,438	$ 921,562	$ 900,000	$ 300,000		
Utah	Blue Cut/ Mammoth Unit	**9/30/2016**	$ 5,500,000	$ 1,850,000	$ 3,650,000	$ 500,000	$ 1,350,000	$ 1,350,000	$ 1,900,000	$ 1,750,000	
Utah	South Valley Lateral Salinity Project - Sheep Creek	**9/30/2016**	$ 4,026,265	$ 2,005,000	$ 2,021,265	$ 584,370	$ 1,420,630	$ 1,705,000	$ 1,650,000	$ 371,265	
Utah	Huntington Cleveland Project Continuation	**3/31/2015**	$ 1,109,913	$ 173,015	$ 936,898	$ 69,857	$ 103,158	$ 103,158	$ -	$ -	
		TOTALS	**$ 50,780,021**	**$ 31,780,556**	**$ 18,999,465**	**$ 22,027,187**	**$ 9,729,291**	**$ 10,051,688**	**$ 9,814,856**	**$ 6,880,931**	**$ 1,131,825**
	PROJECTS THAT ARE FULLY OBLIGATED - NOT YET CLOSED OUT										
Utah	Huntington Cleveland Irrig Co.	**12/31/2012**	$ 22,006,423	$ 22,006,423	$ -	$ 22,006,423	$ -	$ -	$ -	$ -	
Utah	Ouray Park Canal Rehabilitation Project	**12/31/2013**	$ 2,676,000	$ 2,676,000	$ -	$ 2,676,000	$ -	$ -	$ -	$ -	
Colorado	Minnesota Ditch Project 1	**9/30/2015**	$ 3,943,272	$ 3,943,272	$ -	$ 3,943,272	$ -	$ -	$ -	$ -	
Utah	Cottonwood Creek Project 1	**12/31/2014**	$ 6,509,548	$ 6,509,548	$ -	$ 6,509,548	$ -				
	CONTRACT COSTS							**$ 10,051,688**	**$ 9,814,856**		
	NON-CONTRACT COSTS							**$ 500,000**	**$ 600,000**		
	TOTAL OPEN AGREEMENTS		**$ 64,501,771**	**$ 44,118,323**	**$ 20,383,448**	**$ 32,878,791**	**$ 11,215,455**	**$ 10,551,688**	**$ 10,414,856**	**$ -**	**$ -**
Funding	**Appropriations S10**							**$ 6,100,000**	**$ 6,360,000**		
Funding	**Cost Share X10**							**$ 2,614,286**	**$ 2,725,714**		
Funding	**Recoveries S10**							**$ 373,558**			
Funding	**Recoveries X10**							**$ 160,096**			
Funding	**Additional Appropriations S10**							**$ 915,000**	**$ 954,000**		
Funding	**Additional Cost Share X10**							**$ 392,143**	**$ 408,857**		
	TOTAL							**$ 10,555,084**	**$ 10,448,571**	**$ -**	**$ -**
Funding	**Appropriations/Cost Share Totals**							**$ 10,555,084**	**$ 10,448,571**	**$ -**	**$ -**
Costs	**Contract/Non Contract Totals**							**$ 10,551,688**	**$ 10,414,856**	**$ -**	**$ -**
								$ 3,396	**$ 33,715**	**$ -**	**$ -**
	BASIN STATES PROGRAM AGREEMENTS SELECTED IN THE FY 2010 FOA - *THESE PROJECTS ARE NOT CALCULATED IN YEARLY APPROPRIATIONS*										
Wyoming	Farson Eden	**12/31/2013**	$ 1,712,969	$ 1,712,969	$ -	$ 1,633,548	$ 79,421				
Colorado	Uncompahgre Eastside Lateral Phase 7	**12/31/2015**	$ 3,183,983	$ 1,800,000	$ 1,383,983	$ 493,257	$ 1,306,743	$ 800,000	$ 1,383,983		
Utah	Hancock - State Road Project	**12/31/2013**	$ 2,315,250	$ 2,315,250	$ -	$ 2,215,250	$ 100,000	$ 100,000			
	TOTALS		**$ 7,212,202**	**$ 5,828,219**	**$ 1,383,983**	**$ 4,342,055**	**$ 1,486,164**	**$ 900,000**	**$ 1,383,983**	**$ -**	